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The Research Quarterly

of the

American Physical Education Association

Vol. IV OCTOBER, 1933 No. 3

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Published March, May, October, and December

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Published March, May, October, and December

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Subscription $3.00 per year. Single Copies, $1.00 each

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A Study of the Relationship Between Participation in College Athletics and Vocational Success

By M. N. THISTED, PH.D.
Dean of Men, Western Illinois State Teachers College, Macomb, Illinois

FOR THE past ten or fifteen years, intercollegiate athletics has been forced to defend itself against the charge that it was getting out of hand and was becoming a commercialized undertaking instead of remaining an educating agency.* That we have not advanced far with our scientific attempts to measure the values of intercollegiate athletics has been ably expressed by Coleman R. Griffith of the University of Illinois as follows: "On the psychological side there have been attempts to determine the extent to which sportsmanship, courage, and determination, in so far as they are nurtured on the athletic field, can be carried over into later life in order to become effective in business, industry, or the professions. The very fact that the figures on the statistics which are available here, like those in the question of longevity and resistance to disease, can be used to prove either side of the argument, shows how much further we must go in this group of problems before we can say what the real effect of competition is on athletes." †[4]

The majority of educational, professional, and business leaders assign values to intercollegiate athletics. This estimate has generally been based on opinion alone. A few investigators have attacked the problem from a scientific or semi-scientific point of view, but because of the multiplicity of measuring instruments and different methods of attacking the problem, confusion in results persists. The favorable reaction towards athletics is probably due, to a great extent, to the remarkable increase in athletics and athletic facilities during the past few years, which is in turn due almost entirely to the desire of young men to voluntarily take more and more part in athletics.

REVIEW OF SIMILAR STUDIES

There have been very few studies in this particular field. Using as the criterion of success membership in *Who's Who,* Thornhill and Landis[6] concluded from a study of seventy-seven Wesleyan alumni that "There

*A paper presented at the Research Section Meeting, Annual Convention of the American Physical Education Association, April, 1933.
†Numbers refer to bibliography at end of article.

is little evidence that participation in athletics as a player has either positive or negative value so far as its effect on success in life is concerned. The positive value of physical training, team work, etc., is balanced against the fact that athletic ability has been shown in several previous studies to have practically zero correlation with intelligence."

A tentative conclusion drawn by Bridgman[1] in his study of over 1300 college graduates in the employ of the Bell Telephone Company was that while athletic achievement in college is a distinctly favorable factor as a prognosticator of financial success in that company, "it makes relatively little difference whether a man is a member of a major team or merely a minor team or varsity squad." His method of distinguishing between membership on a major team as over against that on a varsity squad is not clear to me, nor do I agree with his rating the position of manager of major team as "Substantial Achievement" as compared with his rating of member of major varsity squad as merely "Some Achievement."

Chapin[2] concludes from a study made of over 400 alumni of the University of Minnesota that 60 per cent of those who participated in college athletics are still participating in the same forms of athletics.

Covell [3] made a follow-up study of West Point graduates, 894 non-athletes and 174 major letter men, and found that 11.63 per cent of the former have achieved distinction in life while 12.07 per cent of the athletes have achieved similar distinction.

It will be seen that the alumni who were active in college athletics represented but a small percentage of the subjects in any of the studies reported and have therefore been treated very inadequately.

PURPOSE OF THIS STUDY*

The major purpose of this study is to measure objectively the relationship existing between participation in college athletics and vocational success. It makes a specific attempt to overcome the inadequacies of previous studies by giving athletes equal representation with two other groups of college alumni, those who were active in campus activities other than athletics and those who were non-active in all extra-curricular activities. These three groups will be referred to as the athletic, active, and non-active groups.

SOURCES OF DATA

The subjects were alumni of the State University of Iowa whose years of graduation were between 1905 and 1925, inclusive. The athletic group consists of all men students who were awarded at least one major or minor letter in one or more of the three leading major sports on the

*This paper is intended as a brief summary of Part I of a dissertation presented at the State University of Iowa, July, 1932, and which was prepared under the most helpful and critical supervision of Dr. C. H. McCloy.

campus, namely, football, basketball, and track (including cross-country). The total number of athletes was 422 with 335 or approximately 80 per cent actually graduating from the University.

As this is a comparative study rather than one of cause and effect, active and non-active alumni were selected to match each athlete on year of graduation and as closely as possible on last name or initial of last name. The latter procedure was employed in order that a random selection, from the large number of graduates from each year, might be made, thus avoiding charges of bias in the selection of the two non-athletic groups.

WHAT IS VOCATIONAL SUCCESS?

It is not the purpose of this study to set up a standard of success, as that is obviously an impossibility, considering the variety of occupations included, the geographical spread of residence, etc., but rather to compare members of the three groups on several factors which people in general associate with success. Some studies define success in terms of membership in *Who's Who*, others in terms of rating by former classmates, professors, etc., others in terms of rating by fellow citizens in the community, others in terms of present income or accumulated savings, and some in terms of commissions on sales or on life insurance.

In this study the three groups were compared on the following objective measures of success; present degree held; present occupation; size of community residence; amount of life insurance in force; number of employees under direct supervision; membership in community, state, or national organizations; officerships or committee memberships held in those organizations; number of servants in the home; number and makes of automobiles owned; and average annual earned income by five-year periods since graduation.

PROCEDURE

The data for the first three comparisons were found in the alumni office files while the remainder of the data was secured through a questionnaire. This technique was decided upon as the only practicable one that would serve to collect the necessary data from alumni living in every state of the union and in foreign lands. Preliminary forms of the questionnaire were filled out and criticized by a number of alumni, by a graduate class in tests and measurements, and by a graduate class in advanced statistics. To expedite tabulation of the data, the questions were so stated that all replies could be transferred to Hollerith cards. Questionnaires are considered in general to be in bad repute because of the uncertainty of the number that will be returned and because the persons being questioned often tend to beg the answers wanted. In this study, these objections were avoided to a great extent through careful

construction of the questionnaire by reducing answers to mere check marks or a few words, identifying returned questionnaires by number rather than by name, and by having the letter accompanying the blank printed on alumni letterheads and signed by the alumni secretary. Return envelopes were included and one follow-up letter was sent out. A total of 971 questionnaires were mailed April 4, 1932, of which 22 were returned by the postal department marked "address unknown" leaving 949 to be accounted for. On June 8 a total of 501 blanks, or nearly 53 per cent, had been returned.

RELIABILITY OF THE DATA

The writer has every reason for believing that the information reported on the questionnaires is very reliable. In the first place, the names of the alumni do not appear on the questionnaire and they were assured that no agency, other than the author of the investigation, would have access to the information. In the second place, a check was made between the data reported on both the Alumni Association Survey and the questionnaire and in every case they were identical. In the third place, it is evident from the completeness of the data given and from the comments made by most of the alumni on the available spaces on the blank that they were willing to give the desired information and to take the task seriously. The instructions to each of the alumni carefully avoided asking for comments in order that any that were made would be voluntary and indicative of the attitude towards the study. In the fourth place, it can be assumed that the data from one group will be as reliable as that from the other two groups. In the fifth place, a study which the writer made as an M.A. thesis showed that answers given by hundreds of college freshmen to a four-page personal information blank were highly reliable.[5]

RESULTS

DEGREES NOW HELD AND PRESENT OCCUPATION

Because over 70 per cent of the alumni in this study are in the professions, the occupational distribution follows closely the distribution of degrees. What does the occupational distribution as found in Table I show? In general there is a remarkable similarity between the occupations engaged in by the athletes and those engaged in by the two non-athletic groups. Approximately 53 per cent of the athletes are now actively engaged in the practice of three highly trained professions, medicine, law, and engineering. Another 13 per cent are college or public school teachers, with another 10 per cent engaged in dentistry. In other words over 75 per cent of *all* football, basketball, and track men who graduated from the State University of Iowa between the years 1905–1925 had the intelligence, time for study, driving purpose, interest in

both athletics and academic studies, etc., necessary in the preparation for future service in these highly trained professions. The percentages for the active and non-active groups trained in the same professions are 75 per cent and 81 per cent respectively, for those whose occupations were known.

A STUDY OF THE RELATIONSHIP BETWEEN PARTICIPATION IN COLLEGE ATHLETICS (AND OTHER EXTRA-CURRICULAR ACTIVITIES) AND VOCATIONAL SUCCESS

TABLE I

DISTRIBUTION BY OCCUPATIONAL GROUPINGS OF THE THREE GROUPS OF ALUMNI OF THE STATE UNIVERSITY OF IOWA

Occupational Group	Athletes		Active		Non-Active	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Medicine	64	20.8	39	13.4	61	21.7
Engineering	34	11.1	24	8.23	33	11.7
Law	64	20.8	86	29.5	43	15.3
Dentistry	31	10.1	32	11.0	63	22.3
Public School Teaching	23	7.5	13	4.46	15	5.63
College Teaching	17	5.51	24	8.23	14	4.97
Managerial Service	36	11.7	30	10.3	28	9.95
Finance	6	1.96	7	2.41	4	1.42
Commercial Service	20	6.53	13	4.46	17	6.05
Miscellaneous	12	3.9	23	7.9	4	1.42
Total	307	100.00	291	100.00	282	100.00

There appears to be a significant tendency for non-active men to locate in smaller communities with a median population of about 13,000 while the two active groups locate in larger communities with median populations of about 40,000. Please refer to Table III for this and the following comparisons. The implication is that the non-active men carry over into adult life an aversion to excessive contact with their fellow-men and that the men active in athletics and other activities show a strong tendency towards locating in the larger cities where competition is more keen than in the smaller communities.

AMOUNT OF LIFE INSURANCE CARRIED

Is the amount of life insurance that an alumnus of this University carries a worth while measure of his social and economic status? The data on this question were given by practically every subject in this study and every evidence points to the seriousness with which these data were given. The median amounts of insurance are: $19,360 for the active group; $16,500 for the athletes; and $13,270 for the non-active

group. It was found that 3.44 per cent of the athletes and 3.11 per cent of the active men carry insurance to the amount of $95,000 or more, while only .67 per cent of the non-active group exceeds $95,000. The median amount of insurance carried by all the alumni in this study is $17,000. A correlation of $0.562 \pm .021$ was found between amount of life insurance and annual income.

EMPLOYEES UNDER DIRECT SUPERVISION

Because the majority of the subjects are in professions which seldom require more than one secretary or assistant, the medians of all three groups are less than three. The non-active group does not measure up quite as well as the other two groups, both of which have twice as many men who employ ten or more as the non-active group.

This measure of vocational success may be a valid criterion if the groupings were made up of the vocational groupings that have large numbers of employees. For a study of the vocational success of men in a large number of occupations, especially medicine, law, and dentistry, it is of little if any value.

MEMBERSHIP IN COMMUNITY ORGANIZATIONS

It is of great interest to note the part that college graduates play in the activities of their communities. The number and types of organizations to which they belong give an estimate of how well their education has fitted them to assume an active part in the life of society. Question number 26 on the blank asked each alumnus to indicate the number of organizations to which he belongs, and also to name these. Our data substantiates previously found results in that the active group belongs to more organizations than either of the other two, the medians being: active—7.25; athletes—6.327; and the non-active—5.865. An outstanding contribution of this comparison is the extent of community activity for the non-active group. It appears that it is erroneous and contrary to fact to assume that the alumni who were non-active in college activities will also be comparatively non-active in community life. There is a significant tendency for more athletes to join the Elks Lodge than for either of the other two groups. The athletic group belongs to more golf, country, athletic, fun, yachting, social, and community clubs than either of the other groups. This fact was to have been anticipated because of the extensive athletic training of the athletic group while in college. There is a large representation from each group in the American Legion, church, and in fraternity alumni associations. Although none of the alumni in this study have achieved high political positions, there appears to be a significant tendency for the athletes to hold more minor political offices than either of the other groups, the numbers noted are: athletes—18; active—6; and non-active—2.

OFFICERSHIPS AND MEMBERSHIPS ON COMMITTEES

The election to an officership or membership on important committees, being in the great majority of cases the result of the judgments of a large number of men, given indirectly, may therefore be considered a valuable measure of a man's success. In the number of officerships or memberships on committees held by the alumni in this study, the active group leads the other two groups, the median number for each group being: active—3.83; athletes—3.24; and non-active—2.53. This data also shows the same surprising tendency as that noted previously for the non-active group to take a decidedly active part in filling positions of leadership in the community.

The conclusion that can be drawn from data just cited is that when compared on the basis of membership in local, state, or national organizations, all three groups appear to be very active, but when compared on the type and number of officerships and committeeships held, the two groups that were active in college activities show a decided superiority over the non-active. It would be very questionable to assume from this that the non-active men are less capable, and it is probably more valid to assume that these men show less interest in holding such positions and are therefore not chosen by their fellowmen for positions of leadership.

NUMBER OF SERVANTS IN THE HOME

It has been assumed in some studies and in at least one score card for rating the economic status of the home (Sims Score Card for Socio-Economic Status) that the number of servants in the home is a valuable measure of vocational status of the home. Such an assumption is not verified by the data from this study as nearly one-half of the subjects, all of whom are graduates of a large state university, do not employ any servants. Approximately 70 per cent of these alumni report that they employ one part-time servant or none.

NUMBER AND MAKES OF CARS OWNED

This is another measure of vocational status which has been used in the Sims Score Card for Socio-Economic Status with scores assigned to the number of cars only. In this study an arbitrary score was given to each response to this question which took into account both the number and makes of cars. Four arbitrary groupings of makes of cars were made with a weighting of: *one* for inexpensive makes such as Ford, Chevrolet, Plymouth, and Whippet; *two* for medium-priced makes such as Dodge, Essex, Pontiac, Oldsmobile, Marquette, De Soto, and Oakland; *three* for higher-priced makes such as Chandler, Willys Knight, Buick, Reo, Chrysler, Auburn, Studebaker (Commander or Dictator), Graham-Paige, Hudson, and Hupmobile 8; and *four* on the highest-priced makes

such as Packard, Lincoln, Peerless, Locomobile, Franklin, Pierce Arrow, La Salle, Cadillac, Studebaker President, and Marmon.

To illustrate the method of assigning weightings, scorings will be made on a few individuals. A man owning a Ford would receive a score of one. A man owning a Buick and a Dodge, receives three credits for the Buick and two for the Dodge or a total of five points. The median scores show a tendency for the athletes to own cars in group three, while the scores for the other groups of alumni show a tendency to own cars found in grouping two. It was also found that there is a fairly strong tendency for more athletes to own cars with a weighted score of three or more than is true of other groups, the percentages being: athletes—55 per cent; active—45 per cent; and the non-active—42 per cent. It appears evident that the athletic group as a whole, should be given a slightly higher ranking on vocational success, as measured by the weighted scores assigned to cars owned. A correlation of $0.672 \pm .017$ was found between automobile score and annual income, indicating that further use of this scoring device may be profitable.

INCOME BY FIVE-YEAR PERIODS FOLLOWING GRADUATION

The writer has no apologies to make over the use of income as one of the measures of vocational success, especially in the professions, where the quality of service rendered to the community—professional, social, and business—determines the quality of clientele and, incidentally, the amount of income.

Fortunately, over 50 per cent of the alumni did not consider the questionnaire as an impertinence or even as an imposition, but returned it with complete data.

In choosing the years for which income should be indicated, the writer began with the year 1905 and requested average incomes over the several five-year periods, ending with the 1925–1929 income. The latest income asked for was for 1925–29 rather than for 1932 because it was believed that a man would feel less hesitant about giving his income of three years ago than he would about giving his present income. Five-year periods were used in place of single-year periods in order that the length of the task would seem less. The task of indicating incomes in the several periods was simplified for both alumni and the writer by establishing ten class intervals ranging from $500–$1400 to $9500–up. It was possible through the use of these two techniques to get alumni estimates of their incomes during five-year periods from date of graduation to the present rather than present income only.

The median is generally regarded as superior to the arithmetic mean in the analysis and comparison of incomes and is therefore used throughout this section of the study. Had it been possible to use the arithmetic

mean, the results might possibly have been in favor of the athletes on each analysis as they outnumbered the other groups in the income range of $9500 or above. (The figures for the 1925–1929 period being athletes —28; active—23; and non-active only 15.)

The alumni were divided into five groups on the basis of years of graduation, 1905–9, 1910–4, 1915–9, 1920–4, 1925–9, and each group was followed through separately, indicating average annual income for each five-year period following graduation. Of alumni, graduating between 1920–4 and 1925–9, athletes are receiving today larger incomes than alumni of the other two groups. The athletes are tied for the lead with the active alumni for the years 1910–4. Of alumni graduating between 1905–9, the active group is now receiving a somewhat higher income than either the non-active or athletic groups, the medians for the years 1925–9 are $7500, $7333, and $6900, respectively. The non-active group leads the other two for the years of graduation, 1915–9. Taken as a whole there is a striking lack of systematic differences in financial success between the three groups over short or longer periods of time.

AVERAGE INCOMES OF OCCUPATIONAL GROUPINGS

Comparisons have been made thus far of measures of success between the three groups of alumni. The most defensible comparison between the groups according to annual income can be made when the incomes are distributed according to the occupational groupings.

The distribution of incomes in Table II shows the following differences: (1) in medicine, the athletes report incomes of greater magnitude

TABLE II

DISTRIBUTION BY OCCUPATIONAL GROUPS OF THE MEDIAN INCOMES RECEIVED BY THE THREE GROUPS OF ALUMNI DURING THE PERIOD 1925–1929

	Athletes		Active		Non-Active		All Alumni	
Occupations	N	Income	N	Income	N	Income		
Medicine	28	$8450	27	$5616	34	$7780	89	$7600
Law	39	$5575	41	$4616	17	$5200	97	$5138
Dentistry	18	$4783	15	$4750	23	$4700	56	$4750
Managerial Service	19	$3379	19	$3950	13	$3200	51	$3492
Finance and Commercial Service	13	$4075	5	$2283	10	$3200	28	$3450
Engineering	21	$4325	13	$4700	20	$2783	54	$3395
Public School Teaching	19	$3172	12	$3250	7	$3200	38	$3200
College Teaching	13	$3825	17	$2750	10	$2950	40	$3154
Miscellaneous	8	$2450	12	$3250	11	$2675	31	$2900
Total	178		161		154		484	

than either of the other groups, the difference between the athletes and the active group being very great, $2,834, and the difference between the athletes and the non-active group is $630; (2) in engineering, the active group leads the athletes by $375 and the non-active group by nearly $2,000; (3) in college teaching, the athletes receive on the average $1,000 more than either of the other groups; (4) there is a tendency for the active group to exceed the other groups in income derived from managerial service; (5) the athletes show a decided tendency to receive a larger income in finance and commercial service than that received by the other groups.

TABLE III

A Comparison of the Three Groups of Alumni of the State University of Iowa on Various Measures of Vocational Success

	Athletes (180)	Active (160)	Non-Active (150)
Median size of community of residence....	39,000	46,000	13,000
Median amount of life insurance carried...	$16,500	$19,360	$13,270
Median number of memberships in national, state, and community organizations.....	6.33	7.25	5.86
Members of golf, country, athletic, gun, and yachting clubs.....	79	45	42
Holders of Political Office.....	18	6	2
Members of Kiwanis.....	15	20	17
Members of Rotary.....	20	19	11
Members of chamber of commerce or commercial club.....	60	42	26
Members of American Legion.....	52	51	39
Median number of officerships held in national, state, and community organizations	3.2	3.8	2.5
Type of car owned by the typical alumnus	Buick Chrysler Hup-8	Oldsmobile Dodge Pontiac	Oldsmobile Essex Pontiac
Median annual income during the period 1925–1929	$4167	$4259	$3913
Number having annual incomes over $10,000 during 1925–1929.....	28	23	15
Median sport score representing the amount of participation in adult sports and recreation since graduation.....	12.7	4.2	3.2

There is a striking similarity between the incomes received by all three groups in the professions of law, dentistry, and public school teaching, in spite of the fact that the number of cases varies greatly from group to group within these professions. The writer believes that this is an indication that the alumni in this study have made very accurate estimates of their incomes.

SPORT CLASSIFICATION AND VOCATIONAL SUCCESS

Are there any striking differences between athletes who specialized in either football, basketball, or track when compared on the basis of vocational success?

TABLE IV

DISTRIBUTION BY MEASURES OF VOCATIONAL SUCCESS OF THE ATHLETES WHEN GROUPED ACCORDING TO THE ATHLETIC SPORT IN WHICH THEY TOOK MOST ACTIVE PART

Sport Specialty	Measures of Vocational Success				
	Median Income 1925–1929	Score on Cars	Member-ships	Officer-ships	N
Football	$4736	2.73	5.75	1.25	57
Basketball	$4700	2.87	6.71	.92	27
Track	$3950	3.10	5.74	1.35	75
Football and Basketball[1]	$4116	3.0	3.5	2.00	4
Football and Track[2]	$3783	3.07	6.0	1.60	11
Basketball and Track[3]	$3450	1.0	3.5	1.00	2
All Three[4]	$6100	4.0	5.75	1.12	5

[1] These are athletes who participated to an equal amount in football and basketball and are not included elsewhere.

[2] These are athletes who participated to an equal amount in football and track and are not included elsewhere.

[3] These are athletes who participated to an equal amount in basketball and track and are not included elsewhere.

[4] These are athletes who participated to an equal amount in all three sports and are not included elsewhere.

The findings of the present study indicate that football and basketball men are receiving approximately $800 a year more than the track men. The total number of basketball and football men is eighty-four as compared with seventy-five track men. Although the number of men in the various combinations is small, the same tendency exists for the combination of football and basketball men to receive a slightly higher income than combinations including the track men. Only five alumni participated in all three sports but their median income is almost $1500 more than any other grouping.

The data on other measures of vocational success show no striking differences between the sport groups. On number and make of cars owned, the three-sport-group individual again leads the rest by owning an expensive car, while the typical athlete of all other groups owns a high-priced car. The typical athlete holds membership in six organizations and holds one officership.

These results are in general in favor of the team-game men when contrasted with the individual-sport men. The writer does not imply any causal relationship from these results, but, even assuming that the men going into these team-sports have qualities that make for success in

these sports, the experience can surely be credited with providing a crucial test of these qualities. This experience is present to a less degree in individual sports.

WINNING GAMES IN COLLEGE VERSUS WINNING SUCCESS IN LIFE

Is there any relationship between winning games in college and achieving success in life? William T. Foster, designated in the *Carnegie Bulletin, Number Twenty-four,* as "always a militant opponent of intercollegiate athletics" (p. xxii) criticizes severely a study of ninety football players who had achieved prominence in their careers because it did not differentiate between "playing games" and "winning games."

TABLE V

DISTRIBUTION BY MEASURES OF VOCATIONAL SUCCESS OF THE ATHLETES WHEN GROUPED ACCORDING TO THE SUCCESS IN WINNING CONTESTS OF THE VARSITY TEAMS ON WHICH THEY PLAYED

Measures of Success	Groupings		
	(1) Teams Won More Contests than They Lost	(2) Teams Lost More Contests than They Won	(3) Teams Won as Many Contests as They Lost
	N = 104	N = 45	N = 32
Median Income 1925–1929	$3929	$5150	$5283
Median Score on Automobiles	2.5	2.9	2.43
Median Number of Memberships	5.5	5.9	6.33
Median Number of Officerships	1.1	1.6	1.3

It is possible here to give an estimate of the relationship existing between winning games and achieving success in life. The athletes, 181 in number, were divided into three groups: 104 who played on varsity squads that won more contests than they lost; 45 who played on varsity squads that lost more contests than they won; and 32 who played on varsity squads that won as many contests as they lost. The athletic records of the University supplied the necessary data. The median incomes at present for these groups are $3,929; $5,150; and $5,283 respectively. The most striking comparison to be found is that the typical athlete who played on "winning" teams now receives an income $1,271 less than the typical alumnus who played on "losing" teams or teams that "broke even."

The question may be raised, "To what extent is this difference a real

difference?" Probable error formulas measure only errors which arise through sampling. In this study no attempt was made to secure a sample of the athletic alumni of the University of Iowa, but all athletes graduating between the years of 1905 and 1925 were included. Data were secured from 181 or a large majority of these alumni. Theoretically these alumni are not a sample of the University of Iowa athletes, nor are they a sample of university alumni the country over. They were chosen because they were accessible and, as graduates of a Big Ten university, they were considered as typical of university athletes in the Mid-West.

TABLE VI

DISTRIBUTION BY MEASURES OF VOCATIONAL SUCCESS OF THE ATHLETES WHEN GROUPED ACCORDING TO THE EXTENT OF ATHLETIC PARTICIPATION AS MEASURED BY WEIGHTED SCORES ON LETTERS WON

Athletic Participation	Measures of Vocational Success				
	Median Income 1925–1929	Score on Cars	Member-ships	Officer-ships	N
14 or more	$5000	3.83	5.50	1.21	14
11–13	$5000	3.00	4.75	.83	18
8–10	$4236	2.20	5.05	1.27	45
5– 7	$4387	2.75	6.35	1.23	38
2– 4	$4065	2.22	6.41	1.28	66

Explanation of Weighting.—A simple arbitrary weighting was assigned to major and minor letters won by the athletes. A value of two was given to all minor letters and a value of three was given to all major letters. The major difference between the athletic experiences of major and minor letter winners is probably that the major letter winner plays in more games or wins more places (in track meets) than the minor letter winner. They both take active part in practices and make the trips, therefore the writer arbitrarily valued a minor letter as two-thirds of the value of a major letter.

Applying the formula for the probable error of the difference between medians, it is found that the chances are sixty-two out of one hundred that the true difference is greater than zero. Upon considering the fact mentioned above, that the athletes in this study represented, not a sampling of all the athletes during the twenty-one year period, but a large majority of all athletic graduates of a single university and for a given span of years, there appears warranted the conclusion that for University of Iowa athletes, at least, there is a real difference in incomes in favor of the athletes who lose 50 per cent or more of the contests in which they participated.

The other measures of success show no striking differences between the groups.

EXTENT OF ATHLETIC PARTICIPATION AND VOCATIONAL SUCCESS

In an effort to determine the relationship between the athlete's extent of participation in college sports and vocational success, the

available data were compiled. Several tendencies are to be noted. In the first place the average incomes tend to increase with increases in amount of participation. The median income for the thirty-two men who earned four major letters or more was $5,000, while the median income for the sixty-six men who earned two minor letters or its equivalent was $4,065. The scores on cars owned tend to increase with increases in amount of participation. This tendency is reversed in the cases of memberships and officerships in community organizations.

TABLE VII

A Percentage Distribution for the Three Groups of Alumni According to the Extent of Participation in Sports since Graduation with Scores Corrected for Years Since Graduation

Average Sports Score	Athletes	Active	Non-Active
90–over	2.72		
85–89			
80–84	.68		
75–79	1.36		
70–74	2.06		
65–69	.68		
60–64	2.06		
55–59	.68		
50–54	.68		
45–49	2.06		
40–44	.68		
35–39	1.36		
30–34	5.13	.91	.92
25–29	8.32	1.80	1.81
20–24	3.21	.91	.92
15–19	12.82	2.72	3.64
10–14	17.9	14.5	9.09
5– 9	14.75	24.49	16.18
0– 4	23.7	53.5	77.42
Number	156	111	110
Median	12.72	4.21	3.22
Arithmetic Mean	20.65	6.05	4.30
Standard Deviation	22.35	5.85	6.95

One possible explanation of these results is that the very active athletes profit in a financial way from their reputations, and incidental learnings in athletics, more than the less active men do. It is possible that the less active men in athletics were more active in other extra-curricular activities than the very active athletes, resulting in a greater carry-over into community organizations.

PARTICIPATION IN ADULT SPORTS SINCE GRADUATION

Comparing the three groups on the amount of postgraduate participation in adult sports, it was found that the typical athlete is three

times as active as the typical active alumnus and four times as active as the typical non-active alumnus. In other words, the typical athletic alumnus participates in sports four times a week, the typical active alumnus only once a week and the typical non-active alumnus only three times a month. This appears to be one of the most important findings of this study. If it is considered advisable for adults, especially professional men who are confined to considerable office work, to continue some form of athletic activity as they advance in age, then it appears evident from the data that the student who participates successfully in intercollegiate athletics (football, basketball, and track) receives a training and an impetus in keeping physically fit which serves him well in later life. Had this study included successful athletes in such sports as tennis, baseball, golf, swimming, etc., which are the leading sports participated in by adults, the results of the comparisons would probably have been still more striking.

SUMMARY

1. Over three-fourths of the athletes in this study prepared themselves while in the University to follow one or another of the leading professions.

2. Athletes and active alumni are found living in communities three times larger than those in which non-active alumni are living.

3. There is a larger percentage of athletes with life insurance of $55,000 or above than there is of the other groups combined, although the median of all athletes is slightly less than that of the active group, but greater than that of the non-active group.

4. Athletic alumni hold fewer memberships and officerships in local, state, or national organizations than do the active alumni, but more than the non-active alumni.

5. "Number of servants in the home" was of no value in this study as over two-thirds of all alumni report either "none" or "one part-time."

6. According to an arbitrary weighting scheme on number and make of car owned, devised by the author, the athletic group has a higher success rating than either of the other groups. Of alumni whose scores on cars were seven or higher, ten were athletes, three were active, and two were non-active.

7. There is little difference between the median incomes of the three groups for the years 1925–9. Of alumni graduating since 1920, the athletes are receiving today annual incomes considerably higher than either of the other groups. There appears also a tendency for a greater number of athletes to report incomes of $9,500 or over than is true of the non-athletes.

8. The alumni who had specialized in either basketball or football

are now receiving larger annual incomes than those who specialized in track.

9. Of the athletic alumni, 77 who were members of teams that lost more than one-half of the contests taken part in, receive today a median annual income of over $5,200, while 104 who were members of teams that won more than one-half their contests, receive today a median annual income of only $3,929.

10. There appears to be a positive relationship between the extent of participation in college athletics and financial success, and a slight negative relationship between extent of athletic participation and memberships in community organizations.

11. Athletic alumni have continued their interest and participation in athletic sports to the degree that the typical athletic alumnus indulges in sports three times as much as the active alumnus, and four times as much as the non-active alumnus.

GENERAL CONCLUSIONS

1. This investigation shows that students participating to a considerable or great extent in intercollegiate athletics show no evidence of having been handicapped by this participation, either while in college or in later vocational life. The charge has been made repeatedly that extensive participation in college athletics interferes to a greater or lesser extent with the intellectual, educational, psychological, and vocational preparations of the participants. The available evidence seems to place the burden of proof upon those making such charges.

2. This study does not postulate any cause or effect relationship between participation or non-participation in college athletics and vocational success but does conclude that the student's college record of activeness or "non-activeness" in the various types of extra-curricular activities may be a valuable selective agency in identifying those human qualities that play a leading part in later vocational success.

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Water Resistance in Swimming

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ALTHOUGH the primary requirement in swimming is to overcome water resistance, very little objective experimentation has been done in this field.* An evaluation of resistance offered by the water in swimming is necessary in dealing with the following problems, which are typical of many others not mentioned:

1. Estimation of the useful work done.

2. Determination of the efficiency of swimming as a type of locomotion.

3. Solution of practical questions arising in coaching, such as: value of "hydroplaning," level at which head should cut the water, and desirable arm and leg functions.

Literature on this subject is meager and the results obtained are incomplete. R. DuBois-Reymond (1905) towed several persons behind a row boat, measuring resistance by a dynamometer. G. Liljestrand and N. Stenström (1919) towed swimmers by means of a windlass on shore, the towing rope running over a pulley which in turn operated a spring scale. F. Houssay (1912) measured resistance indirectly by measuring the force that the swimmers could develop in actual swimming situations. Amar (1920) mentioned the formula for water resistance as being "Resistance=$K \times S \times V^2$." K is a constant equal to 73 or 55; S is the area in square meters of the greatest cross section of the body of the swimmer; and V is the velocity in meters, squared.

Owing to insufficient experimental data derived from work with human beings, it has been customary to use formulae of resistance computed in connection with ship models. Such a procedure naturally introduced errors in view of the disparity between men and boats as regards form.

The present experimentation was commenced in 1929 with the desire to find formulae which would be accurate for human beings.

METHOD USED IN THE PRESENT RESEARCH

The swimmer was towed through the water in a sixty-foot pool by means of an electric motor. The tension of the towing rope and the speed

*Paper presented before the Research Section of the Eastern District Association Convention, Springfield, Massachusetts, April, 1933.

of movement were recorded graphically by a resistograph in the manner illustrated below.

The towing cord (C) held by the swimmer passes over the ball bearing pulleys and is attached to the drum (D) driven by an electric motor. The tension developed in the cord stretches the spring (S) and is recorded on the kymograph. Each revolution of the drum (D) and the time intervals of one-twentieth of a second are also automatically recorded on the kymograph. Knowing the circumference of the drum and the

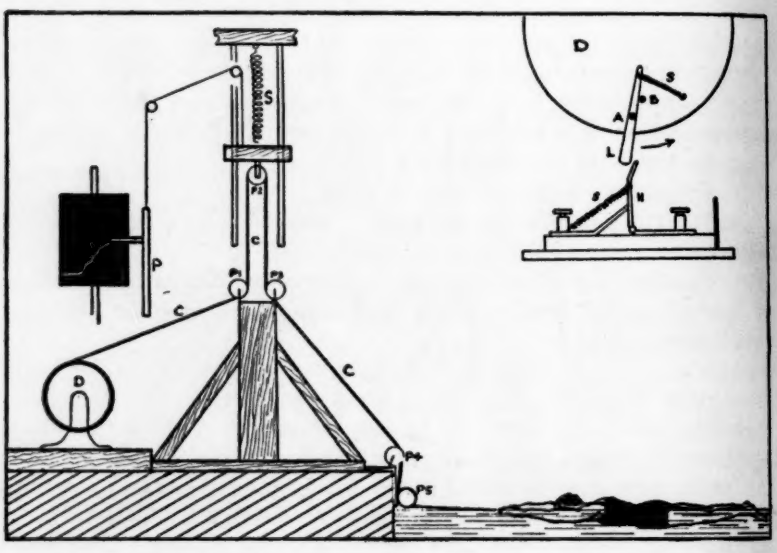

FIG. 1.—Diagram of the Resistograph: C, towing cord; P_1-P_5, ball-bearing pulleys; S, calibrated spring; D, electric motor.

Switch for Recording Revolutions of the Drum: (Insert in upper right corner) L, lever rotating around A; H, hinge held in contact with B. In operation L breaks the contact between B and H, interrupting an electric current.

time, we secure the speed of towing. The electric motor was of three h.p., and could be used with various speeds and reverse action. Six apparatus have been designed in the course of this study; the one described is the last and best.

Practical Remarks.—In experimenting the following should be remembered: The pulleys should be on ball bearings, and pulley P_2 should be exactly in the middle, between pulleys P_1 and P_3. Pulley P_5 should be close to the surface of the water. To eliminate the effect of the towing cord, the readings on the resistograms should be taken when the swimmer is covering the last ten yards of the pool. Experiments showed that the error involved then cannot be detected by the resistograph and therefore can be disregarded. In testing, it is better to maintain a uniform speed long enough to get a straight line, as in Figure 2.

RESISTANCE IN GLIDING POSITION

In order to secure a uniform body position in the water, the feet of the tested subject were supported by means of a stick of balsa wood attached by strips of adhesive tape between the legs. In his hands he held a piece of balsa board attached to the towing cord. The balsa wood was well sandpapered and varnished.

These tests with floats showed the relationship between speed and resistance only. Normally the position of the body varies somewhat

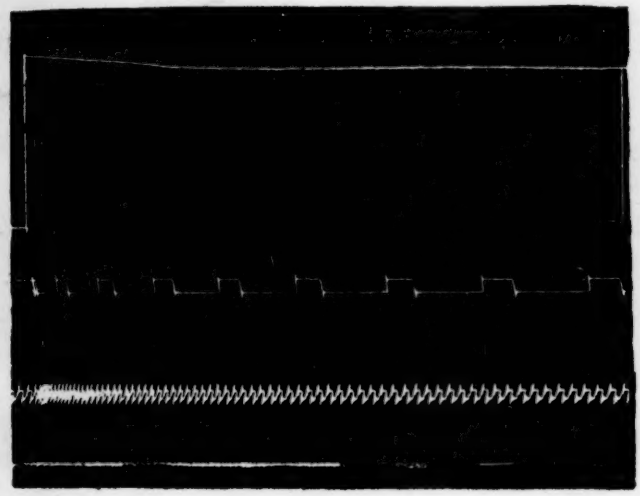

FIG. 2.—A Resistogram: The upper line shows water resistance; the middle line, revolutions of the drum; the lower line, time in intervals of 1/20th second.

with the change in speed because with lower speeds there is a tendency for the feet to sink deeper. Subjects were also towed without any support; these tests showed the ratio between the speed, resistance, and change of the body position. Each person was towed between sixty and two hundred times before any attempt to use the data was made.

The value of the resistance for any given speed varied in the same subject, indicating that the body position was not always the same. Since the best body position should be the most economical, in plotting a resistance curve only the minimum resistances were used. Figure 3 illustrates the variation of resistance for the same speed in the same man, and also shows the logarithmic relationship between the speed and resistance. Logarithmic paper was used in order to simplify the finding of the formulae for these lines (E. S. Schoder, and F. M. Dawson, 1927). The same lines reproduced on ordinary graph paper would appear as parabolae, similar to those on Figure 4, plotted for subject "S."

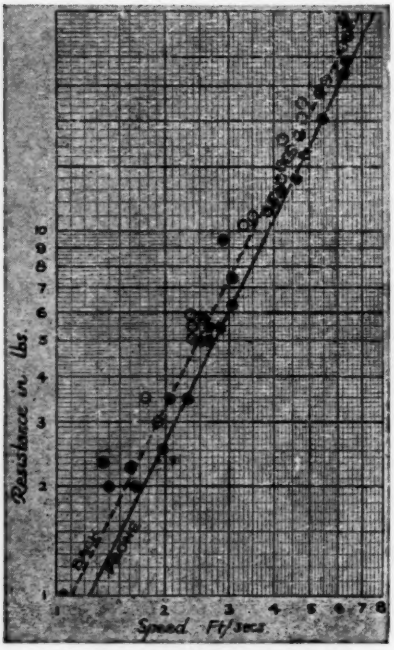

FIG. 3.—Logarithmic Plotting of Water Resistance for Subject "Wei": The dots represent resistances for the prone glide; the circles, resistances for the glide on the back. The formula for the prone glide is $R = .63\ V^2$ and for the back glide $R = .82\ V^2$ where R is the resistance in pounds and V the velocity in feet per second.

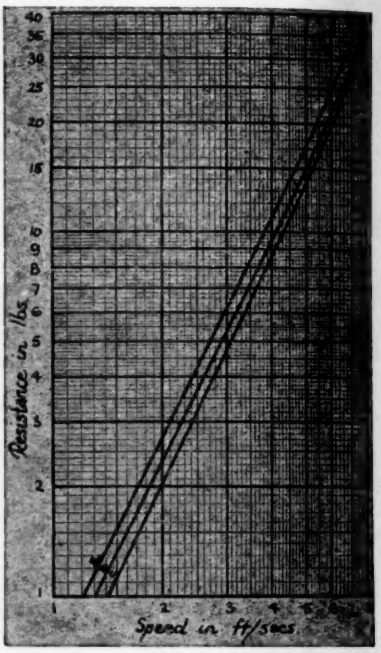

FIG. 5.—Logarithmic Representation of Water Resistance in the Prone Glide: Between a-b, varsity men (Aryan race); between b-c, Japanese and women.

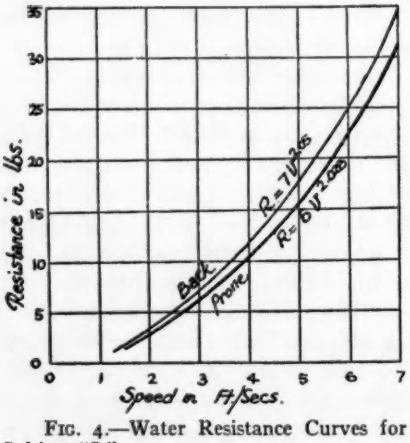

FIG. 4.—Water Resistance Curves for Subject "S."

Figure 5 represents the results of tests on men and women. Between lines (a) and (b) lie the resistances of swimmers of the Aryan race (from 210 to 138 pounds in weight and 73 to 67½ inches in height); between (b) and (c) lie the resistances for women of athletic type and of the Japanese swimmers of average size. Detailed information in regard to each subject is found in Table VI.

TABLE VI

WATER RESISTANCE FOR GLIDES COMPARED WITH HEIGHT, WEIGHT, AND SKIN SURFACE AREA

Name	Skin Surface Area, Square Feet*	Weight, Pounds	Height, Inches	Formulae for Resistance in Pounds Glide	
				Prone	On the Back
Men:					
Fr.	19.18	138	70.	.6 $V^{2.05}$**	.75 $V^{2.01}$
W.	20.65	158	70.5	.8 $V^{2.01}$	.82 $V^{2.02}$
Wei.	20.89	170	69.5	.63 V^{2}	.82 V^{2}
M.	21.87	180	72.	.77 $V^{2.03}$	...
L.	19.612	154	67.5	.61 $V^{2.01}$	.68 V^{2}
C.	20.506	168	68.5	.62 $V^{2.014}$	.69 V^{2}
S.	22.131	180	73.	.6 $V^{2.028}$	.7 $V^{2.05}$
F.	23.977	210	74.	.68 V^{2}	.73 $V^{2.01}$
G.	21.67	160	71.	.7 V^{2}	...
I.***	17.17	124	64.	.51 $V^{2.05}$	.61 $V^{2.01}$
T.***	18.7	147	65.	.56 $V^{2.04}$	.63 $V^{2.01}$
Women:					
N.	17.33	125	64.5	.5 $V^{2.07}$	.61 V^{2}
P.	18.19	142	64.	.47 $V^{2.16}$	.55 $V^{2.08}$
K.	16.48	122	61.	.5 $V^{2.08}$	.6 V^{2}

*McCloy's Tables (1928)
**V equals velocity in feet per second
***Japanese swimmers

From this table we can see that there is a general relation between the size of the subject and resistance. However, it is impossible to use the skin area in the formula, for the reasons following.

As numerous investigations on planes and ship models have shown, the total water resistance consists mainly of three parts (Froude, 1874; Lanchester, 1908):

1. Skin friction.
2. Eddy resistance.
3. Wave-making resistance.

Skin friction is the most important factor for moderate speeds. It varies in proportion to the skin area, and as the 1.7 to 1.92 power of the speed.

Wave-making resistance varies as the fourth power of the speed (Peabody, 1917), and eddy resistance varies as the square of the velocity and the sine of the angle of planes causing the eddies (Bowles, 1883).

The effect of the shape of the object is more pronounced than that of its surface area. An eighteen-foot canoe with two people sitting in it was towed at a speed of seven feet per second. Its resistance was twelve pounds, whereas the average man at the same speed would show a resistance of about thirty pounds.

The effect of body position is also very important, since resistance varies as the sine of the angle of inclination (Saint-Venant, 1888); that is why some small persons show a greater resistance than larger ones.

WATER RESISTANCE FOR THE BACK GLIDE

The resistance for the glide on the back is greater than for the glide in the prone position (Fig. 4). This is contrary to the findings of other investigators (DuBois-Reymond, Liljestrand, and Stenström). The contradiction may be easily explained, for these experimenters towed their subjects without supporting the legs and feet. Without this support, men float better on the back than on the stomach and the body maintains a more horizontal position and hence has a smaller resistance. Up to a speed of 3 feet per second the body in the back glide position remains horizontal, but at greater speed it begins to bend at the hips. When the speed is greater than 7.6 feet per second, most swimmers are forced into a slightly sitting position and only with great effort can they maintain a more or less horizontal position.

THE EFFECT ON RESISTANCE OF LIFTING THE HEAD, BREATHING, "HYDROPLANING," ACCELERATION, AND WEARING A BATHING SUIT

A mere lifting of the head so that the eyes are just above the water level does not appreciably change the water resistance. Every ordinary turning of the head for breathing increases the resistance about one-half pound for a speed of three feet per second, and about one and one-half pounds for a speed of five feet per second. An exaggerated lifting of the head and body, or "hydroplaning," as it is called, invariably increases the resistance. Lifting the head and turning it so as to look backwards also increases the resistance. The resistance is greater during the attempt to attain a certain speed than during the maintenance of that speed. Possibly this explains why some good swimmers lose their races when using a non-uniform rate of speed, thus unnecessarily overcoming an excess of resistance with every acceleration.

No difference in resistance could be ascertained between gliding in the nude and in silk suits. The use of a woolen suit, however, produced an increase in resistance noticeable at fast towing—about one-half pound for the speed of five feet per second. The type of bathing suit is more important than the quality of the material in the suit. A suit which is loose about the back and tight about the legs may considerably increase the resistance.

CONCLUSIONS

A comparison of the values given in the present study, for water resistance in prone and back glide positions, at the same speeds used in previous experiments by various investigators, reveals the importance of proper technique.

Although this comparison cannot be accurately made, owing to the lack of body dimensions in the reports of these early investigators, the assumption that these unknown subjects were average persons will lead to the following comparisons:

Authors	Water Resistance in Pounds				
	Prone Glide		Glide on the Back		
	Speed 1.55 ft./sec.	Speed 3.23 ft./sec.	Speed 2.43 ft./sec	Speed 2.7 ft./sec.	Speed 3.93 ft./sec.
DuBois-Reymond, R.	....	15.43	....	8.81	15.43
Liljestrand, G., and Stenström, N.	4.4	7.71	6.17	....	....
Karpovich, P.	1.5	6.5	4.1	5.0	10.0
Amar, J.	1.2	5.4	....	....	....

The method used by DuBois-Reymond represents an attempt of a pioneer, the main fault in his work being the use of a row boat in towing subjects, the speed being too inconstant to expect accurate results. The method used by Liljestrand and Stenström represents a great step forward and gives more accurate figures, although the number of experiments performed was too small, as they themselves have admitted. The formula mentioned by Amar gives results that are too small, and become smaller if constant 55 is used instead of constant 73.

The apparatus and procedure used in the present study evidently give data more reliable than have been available heretofore. Still more precise figures may be obtained with Froude's machine, used by navies and shipbuilders for testing the water resistance of ship models.

As it is desirable to have formulae at hand which can be used for calculating water resistance, the author has attempted to prepare a simplified table as given below:

	Skin Surface Area in Square Feet	Formulae for resistance in pounds (V = velocity in feet per second)	
		Prone Glide	Back Glide
Men	24–19	.65 V	.75 V
Women and Men	19–16.5	.55 V	.6 V

SUMMARY

Water resistance in swimming for men and women was studied by means of a specially designed apparatus called the "Resistograph."

Formulae were evolved for the water resistance in the glide on the back and on the stomach.

The effect on resistance of turning the head, "hydroplaning," and use of bathing suits has been studied.

I wish to thank Dr. C. H. McCloy for his stimulating discussion of the problem, Coaches J. L. Rothacher and T. K. Cureton, Jr. for their cooperation, and my numerous subjects for their cheerful patience and interest, without which this research would have been impossible.

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A Study of the Subjects Taught by 1037 Teachers of Health and Physical Education

In the Public High Schools of Indiana

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(In cooperation with the State Department of Public Instruction and under the direction of Dr. W. W. Patty of Indiana University)

INTRODUCTION

THE ENTIRE survey of which this study is only a part was undertaken by the State Department of Public Instruction with the cooperation of D. A. Glascock of Indiana State Teachers College and Dr. W. W. Patty of Indiana University for the purpose of determining the status of instruction in health and physical education during the first year in which one unit in the field was required for graduation from high school. The following letter and a rather complete questionnaire were distributed to teachers of health and physical education in March, 1932, through their superintendents and principals:

Dear Teacher of Health and Physical Education:

We are anxious to learn the status of health and physical education in this state, also to obtain certain information relative to the teachers of these subjects.

Will you kindly fill out this questionnaire and return it to your principal? This questionnaire was prepared by David A. Glascock of Indiana State Teachers College, Terre Haute, Indiana, who is chairman of the committee making this study.

Very truly yours,
H. E. Moore,
Acting State Director of Health and Physical Education.

The material for this brief study has been drawn from section twenty-one of the questionnaire which may be obtained from the State Department on request. Section 21 was set out as follows and teachers were asked to encircle the code numbers of the subjects taught and to write in those taught which are not listed.

Twenty-One

Teaching load—encircle subjects you are now teaching

1. Health Education
2. Physical Education
3. Health and Physical Education
4. English
5. Science
6. Social studies
7. Industrial arts
8. Home economics
9. Foreign language
10. Mathematics
11. .....
12. .....

When the incomplete and inaccurate returns were eliminated, 1037 reports remained. This represents about three-fourths of the teachers of health and physical education and consequently includes an adequate section of the entire group. The teachers, as the later tables will indicate, were drawn from all sizes and types of high schools and represent both men and women. The classification so far as size was concerned, as well as separating them into four- and six-year high schools as is set out in the general questionnaire, was followed. No attempt is made to determine the status of the teachers so far as licenses are concerned. This study deals only with what the teachers teach. A study of the licensing situation can and will be made from the same source that this material is taken.

THE PURPOSE OF THE STUDY

The purpose of this study is to set out the subjects taught by teachers of health and physical education in order that students interested in this field may have some guidance toward the subjects that they most likely will be called on to teach. Further, it plans to furnish information to directors of departments of health and physical education and directors of studies and placement bureaus, information that will aid them in directing their students into the fields that they most likely will be called upon to teach. It further aims to call the attention of administrators to the seriousness of the problem.

PLAN OF THE STUDY

The plan of the study will be to set out tables showing the data drawn from section twenty-one of the questionnaire mentioned, in tabular form, as self-explanatory as possible but preceded by an explanation and followed by a brief analysis. At the conclusion of the paper will be found certain conclusions and recommendations. For purposes of the prevention of overlapping it was necessary to divide the teachers into groups teaching health, physical education, and health and physical education. The schools were tabulated on basis of organization and enrollment and men and women teachers were tabulated separately.

SECTION A

Table I sets out the type and size of schools, the sex of the teacher, and the frequency of the subjects taught with health. The tables are self-explanatory and only brief comment need be made about each. Those teaching health only are noted and those that teach health in combination with other subjects are divided into various subject fields and listed in order of frequency. Table I reads that in the four-year schools of an enrollment below one hundred, fourteen men taught health in combination with other subjects, of which social studies appeared seven times, science twelve times, mathematics seven times, etc.

Table I shows that only five teachers reporting taught health *only*, these teachers being located in the larger schools. Ninety teachers taught health in combination with other subject groups, which appeared in the following order: science, home economics, social studies, English, mathematics, industrial arts, foreign language, music, and art. In the schools of under two hundred enrollment, two subject groups were taught (on an average) in addition to health. In the schools above two hundred in enrollment, one subject group in addition to health is usually taught. There appeared to be little difference in the four- and six-year high schools. The number of men and women teaching health was practically equal, there being forty-seven men and forty-eight women. Home economics was the most popular combination with health for women; science and social studies ran high for men. No physical education is listed inasmuch as that subject appears in Table II which deals with combinations with this subject.

SECTION B

Table II deals with the largest number of the three groups. It covers the subjects taught by 325 men and 228 women with physical education. The same plan as was followed in Table I is followed here and so no additional explanation is necessary.

Table II reads that in four-year high schools of less than one hundred enrollment one man taught physical education *only*, while eighty men taught physical education in combination with other subjects, of which social studies appeared forty-seven times, mathematics thirty-four times, science thirty-one times, etc.

Table II shows that 89 teachers teach physical education *only*. These seem to be located for the most part in the larger four-year high schools. The explanation for the four-year part being that the largest high schools of the state are, as a rule, four-year schools. Four hundred and sixty-four teachers are teaching physical education in combination with other subjects. One of the things immediately noticeable is that there are more men

TABLE I

SUBJECTS TAUGHT BY 47 MEN AND 48 WOMEN TEACHERS OF HEALTH IN FOUR-YEAR AND SIX-YEAR HIGH SCHOOLS IN INDIANA

Type of School	Four-Year High Schools														Six-Year High Schools															
School Enrollment	Less 100		100–199		200–399		400–599		600–999		Over 1000		All 4 yr. H.S.		Less 100		100–199		200–399		400–599		600–999		Over 1000		All 6-yr. H.S.		All High Schools		Total
Sex of Teacher	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M F
Subjects Taught																															
Health Education Only	—	—	—	—	—	—	—	1	—	—	—	3	—	4	—	—	—	—	1	—	—	—	—	—	—	—	1	—	1	4	5
Health Education and Combination	14	9	4	6	4	2	—	—	2	4	5	6	29	27	5	1	9	8	2	1	—	—	—	5	1	2	17	17	46	44	90
Subjects in Combination:																															
Frequency of:																															
(1) Science	12	5	—	2	2	1	—	—	—	—	2	1	16	9	3	1	7	6	1	—	—	—	—	3	—	1	11	8	27	17	44
(2) Home Economics	—	7	—	4	—	1	—	—	—	3	—	4	—	19	—	1	—	7	—	1	—	—	—	3	—	1	—	13	—	32	32
(3) Social Studies	7	—	2	3	2	—	—	—	2	—	3	—	16	3	3	—	3	1	—	—	—	—	—	—	1	—	7	1	23	4	27
(4) English	2	4	4	1	—	—	—	—	1	1	—	—	7	6	—	—	3	2	—	—	—	—	—	—	—	1	3	3	10	9	19
(5) Mathematics	7	2	—	—	—	—	—	—	—	—	1	1	8	3	1	—	2	—	—	—	—	—	—	—	—	—	3	—	11	3	14
(6) Industrial Arts	1	—	2	—	1	—	—	—	—	—	—	—	4	—	2	—	1	—	—	—	—	—	—	—	—	—	3	—	7	0	7
(7) Foreign Language	2	1	—	—	—	—	—	—	—	—	—	—	2	1	—	—	—	1	—	—	—	—	—	—	—	—	—	1	2	2	4
(8) Music	—	2	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	4
(9) Art	—	2	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2

TABLE II

Subjects Taught by 325 Men and 228 Women Teachers of Physical Education in Four-year and Six-year High Schools in Indiana

Type of School	Four-Year High Schools														Six-Year High Schools														
School Enrollment	Less 100		100–199		200–399		400–599		600–999		Over 1000		All 4-yr. H.S.		Less 100		100–199		200–399		400–599		600–999		Over 1000		All 6-yr. H.S.		All High Schools		Total
Sex of Teacher	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Subjects Taught																																
Physical Education Only	1	1	1	1	2	3	2	2	13	12	19	18	38	37	1	—	—	1	—	—	—	—	—	3	6	3	7	7	45	44	89	
Physical Education and Combination	80	35	40	33	11	11	5	3	3	—	3	2	42	84	32	24	78	54	23	20	3	2	2	—	—	—	138	100	280	184	464	
Subjects in Combination: Frequency of:																																
(1) Social Studies	47	9	14	1	5	1	3	—	2	—	—	1	71	12	17	5	44	10	10	5	2	2	1	—	—	—	74	22	145	34	179	
(2) Science	31	10	11	5	5	1	—	—	—	—	2	1	49	17	10	2	36	9	3	2	1	—	1	—	—	—	51	13	100	30	130	
(3) Mathematics	34	7	11	6	3	2	1	—	1	—	—	—	50	15	13	2	32	5	7	1	1	—	—	—	—	—	53	8	103	23	126	
(4) English	15	17	6	13	—	4	1	3	—	—	—	—	22	37	5	18	14	22	2	10	1	1	—	—	—	—	22	41	44	78	122	
(5) Home Economics	—	15	—	7	—	1	—	—	—	—	—	1	—	24	—	10	—	25	—	1	—	—	—	—	—	—	—	36	—	60	60	
(5) Foreign Language	10	8	1	10	—	3	—	—	—	—	—	—	11	21	5	6	2	12	—	3	—	—	—	—	—	—	7	21	18	42	60	
(6) Industrial Arts	11	—	4	—	3	—	1	—	—	—	—	—	19	—	2	—	12	—	7	—	1	—	—	—	—	—	22	—	41	—	41	
(7) Commerce	2	2	2	7	—	1	1	—	—	—	—	—	5	10	4	2	4	5	2	3	—	—	—	—	—	—	10	10	15	20	35	
(8) Music	1	6	—	6	—	—	—	—	—	—	—	—	1	12	—	6	—	7	—	1	—	—	—	—	—	—	—	14	1	26	27	
(9) Art	—	5	—	5	—	—	—	—	—	—	—	—	—	10	—	2	—	8	—	4	—	—	—	—	—	—	—	14	—	24	25	
(10) Elementary Grades	6	1	8	2	—	—	—	—	—	—	—	—	14	3	3	—	—	2	1	—	—	—	—	—	—	—	5	1	19	4	23	

TABLE III

SUBJECTS TAUGHT BY 239 MEN AND 150 WOMEN TEACHERS OF HEALTH AND PHYSICAL EDUCATION IN FOUR-YEAR AND SIX-YEAR HIGH SCHOOLS IN INDIANA

Type of School	Four-Year High Schools															Six-Year High Schools															
Enrollment	Less 100		100–199		200–399		400–599		600–999		Over 1000		All 4-yr. H.S.			Less 100		100–199		200–399		400–599		600–999		Over 1000		All 6-yr. H.S.		All High Schools		Total
Sex of Teacher	M	F	M	F	M	F	M	F	M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M F
School Subjects Taught																																
Health and Physical Education Only	—	—	2	1	6	5	3	3	13	10	13	15	37	44		—	—	—	1	5	1	1	—	5	5	6	1	17	8	54	52	106
Health and Physical Education and Combination	35	25	32	16	15	12	2	1	—	—	—	—	83	54		17	7	51	20	30	16	2	1	2	—	—	—	102	44	185	98	283
Subjects in Combination: Frequency of:																																
(1) Science	18	7	10	6	2	2	1	—	—	—	—	—	31	15		12	3	31	8	10	3	1	—	1	—	—	—	55	14	86	29	115
(2) Social Studies	22	6	14	2	8	3	1	—	3	—	—	—	48	11		9	1	13	3	11	5	1	—	—	—	—	—	34	9	82	20	102
(3) Mathematics	16	1	5	4	4	1	—	—	1	—	—	—	26	6		6	—	10	2	4	3	—	1	1	—	—	—	21	6	47	12	59
(4) English	7	11	4	6	2	4	—	1	—	—	—	—	13	22		—	2	8	5	2	11	—	—	—	—	—	—	10	18	23	40	63
(5) Home Economics	—	19	—	6	—	2	—	—	—	—	—	—	—	27		—	6	—	12	—	2	—	—	—	—	—	—	—	20	—	47	47
(6) Industrial Arts	1	—	8	—	1	—	—	—	—	—	—	—	10	—		5	—	11	—	8	—	—	—	—	—	—	—	24	—	34	—	34
(7) Foreign Language	2	2	1	2	1	1	—	—	—	—	—	—	4	5		—	2	—	1	—	1	—	—	—	—	—	—	—	4	4	9	13
(8) Commerce	2	1	2	1	—	—	—	—	—	—	—	—	4	2		—	1	3	—	1	1	—	—	—	—	—	—	4	2	8	4	12
(9) Agriculture	3	—	1	—	—	—	—	—	—	—	—	—	4	—		2	—	1	—	—	—	—	—	—	—	—	—	3	—	7	—	7
(9) Music	—	1	—	—	—	—	—	—	—	—	—	1	—	1		—	1	1	4	—	—	—	—	—	—	—	—	1	5	1	6	7
(10) Art	—	1	—	—	—	—	—	—	—	—	—	—	—	1		—	1	—	—	1	1	—	—	—	—	—	—	1	2	1	3	4
(10) Elementary Grades	—	—	1	—	—	—	—	—	—	—	—	—	1	—		2	—	1	—	—	—	—	—	—	—	—	—	3	—	4	0	4

teachers of physical education than women—there being 325 men and 228 women. This is explained as the table will show that men are largest in number in the smaller schools where evidently they teach physical education to both boys and girls. Social studies, science, mathematics, foreign language, and home economics are most popular. Social studies is by far the most popular combination with physical education for men, with science and mathematics following. For women, English followed by home economics and foreign language are the most popular. Again the tables will show that in schools under two hundred in enrollment two subject groups in addition to physical education are taught; from two hundred to six hundred, one subject group in addition to physical education is usually taught; above six hundred, physical education is usually taught alone. Again, apparently little difference is found between the four- and six-year schools.

SECTION C

Table III covers the teachers of health and physical education. It contains the second largest group with 239 men and 150 women. The same plan that was followed in Tables I and II is followed here. Table III reads that in the four-year high schools of less than 100 enrollment, 35 men taught health and physical education in combination with other subjects; social studies appearing 22 times, science 18 times, and mathematics 16 times in the combinations with other subjects appearing in the order listed in the table. There are several elementary teachers teaching high school physical education as indicated in the table.

In Table III, as in Table II, we find the men outnumber the women teaching this work. This preponderance comes again from the small schools, as evidenced by the almost equal number teaching the subjects only. The same average so far as subjects taught, in addition to health and physical education, appears in this table as is shown in the analysis of Tables I and II. Little difference is again noted between the four- and six-year schools. Practically the same subjects are again found in the combinations with health and physical education as are found in Tables I and II.

CONCLUSIONS

1. There is very little difference in the organization of the health and physical education work as indicated by the subjects teachers teach in the four- and six-year high schools of Indiana. So in the conclusions no separation of the two need be made.

2. There is a larger number of men teaching physical education than women, owing largely to the preponderance of men apparently teaching both boys and girls in the smaller high schools.

3. In high schools of less than two hundred enrollment, two subject groups in *addition* to health, physical education, or health and physical education are usually taught by the teachers.

4. In high schools of enrollments between two hundred and six hundred usually one subject group in *addition* to health, physical education, or health and physical education is usually taught by the teacher.

5. Only in the large high schools (over six hundred) does one commonly find teachers teaching health, physical education, or health and physical education only.

6. For men, social studies appears to be by far the most common combination with these subjects with science, mathematics, and industrial arts following in the order named.

7. For women English appears to be the most common combination with these subjects with home economics, science, and foreign language following closely in the order named.

8. There is little evidence that there has been a real effort to put those subjects in combinations that are most logical and desirable.

9. Evidently the teachers of the academic subjects generally have been forced to take up the physical education and health work when it was added to the curriculum.

10. A number of elementary teachers, particularly men, are teaching high school classes in physical education.

11. There is no real standard for determining the time that ought to be devoted to health and physical education in various-sized schools.

12. This does not necessarily set out a desirable situation but represents actual conditions as they existed during the second semester of the school year 1931-32.

RECOMMENDATIONS

1. The small schools in particular need to select teachers prepared, and urge teachers already employed to prepare, in related fields since it is necessary for them to teach several (three) subject groups in the smaller high schools (under two hundred enrollment) which by far represents the large per cent of the high schools in Indiana.

2. Teacher-training institutions should recognize the need of their graduates to be trained in at least three fields if they are to have a reasonable opportunity for employment.

3. The number of women teachers of health and physical education should approximately equal the number of men instructors, consequently making possible that girls could be taught by women instructors.

4. Employing officials should work toward the elimination of the use of elementary teachers in the high school by urging those elementary teachers to secure additional training.

5. Health and physical education should probably not be combined with such special subjects as art, music, commerce, agriculture, and home economics in such a way as to expect the teacher to handle three of those subject groups, as inadequate time will likely be devoted to three special subjects.

6. Some standards should be worked out that will serve as a measure of the teacher's time that should be devoted to health and physical education in various-sized high schools.

7. Because the teachers teach certain combinations does not mean that all students taking training should follow the same plan. There should be an effort made to improve the situations by encouraging more logical combinations. This effort should be made with superintendents, other employing officials, and in the teacher-training institutions.

8. A better program of health and physical education should be set up—too often as the teaching load indicates, this work is a "side-line" and not a major interest.

A Study of Suitable Majors or Minors That Are Used In Combination With Physical Education

By Claude W. Street, Ph.D.
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THE TOPIC assigned to me is one of pressing importance at the present time to all those concerned with the training of physical education teachers.* The question of teaching combinations did not become acute for institutions providing special curricula for the training of physical education teachers until quite recently. In those golden heydays following the war, when many schools were introducing physical education, specialists in the field were in great demand. It was natural under such conditions that institutions should devote their energies to turning out specialists for the larger schools with little thought of combinations for smaller institutions. Superintendents in the smaller schools had to depend largely upon majors in other fields with a few hours of training in physical education as a means of meeting new state requirements for instruction in health and physical education.

As a former superintendent, I well remember how the physical education majors used to spurn our offers for anything but an exclusive job as special teacher. Now the tables are turned and our majors are eager to get any sort of position in any type of school. It is not surprising therefore that many specialists in teacher training are engaged in studies to determine the most suitable subject combinations for prospective teachers. In times such as these when many schools are finding it extremely difficult to retain their full-time specialists for physical education alone, it behooves us to study carefully the possibility of preparing teachers who can handle physical education acceptably in combination with other major or minor fields.

In attacking the problem our attention should first be directed to the situation in the public schools to which our graduates must look for work. What are the needs of the public schools as to physical education teachers? To what extent are schools employing teachers for work in physical education alone? In how many fields is the new teacher of physical education apt to teach? What teaching combinations are commonly found with physical education?

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* A paper presented before the Teacher-Training Section of the Mid-West District Association Convention, April, 1933, at Wichita, Kansas.

Inexperienced teachers have had in recent years to look increasingly to the small school for initiation into the teaching profession. The larger systems for the most part have rules requiring two or more years of previous experience as a prerequisite to appointment, which shut out practically all beginners.

Let us take a look at these small schools to which our graduates must go. Some idea of their size may be gained from the fact that more than half of the high schools of the United States have an enrollment of less than one hundred. A large proportion of them have high school departments employing only two or three teachers for fewer than fifty students. In these schools it is necessary for the staff members to teach four or five different subjects each, frequently in several unrelated fields. For example, my wife, an English and Latin major, as a neophyte had to teach six subjects in five different fields: English, Latin, German, mathematics, and history in addition to acting as coach for debating and dramatics.

Two recent studies reported in Table I, Section A, show the number of fields in which high school teachers work in two of our Mid-West states. In Iowa one-fourth and in Kansas one-third of the teachers work in three or more fields. Those teaching in one field only are found mainly in the

TABLE I

NUMBER OF FIELDS IN WHICH TEACHERS WORK

A. High School Teachers of Iowa and Kansas
(Percentage distribution as to number of fields taught.)

	Iowa[1] 1929-30 Per Cent	Kansas[2] 1930-31 Per Cent
1 field only	43	29
2 fields	32	36
3 fields	19	24
4 fields	5	8
5 fields	1	2

B. Per Cent of Physical Education Teachers Handling Physical Education alone

	Per Cent
Iowa High Schools, 1928-29 (Men and Women) (Peterson, Lindquist, Price, and Jeep)	9
Iowa High Schools, 1931-32 (Women only) (Elizabeth Halsey)	31
Indiana High Schools, 1931-32 (Women only) (Moore)	23
Illinois High Schools, 1932-33 (Men only) (Arthur F. Smith) (Chicago schools not included.)	14
Kansas High Schools, 1930-31 (Men and Women) (C. W. Ridgway)	22
Secondary Schools of the Southern Ass'n (Men) (Joseph Roemer, 1928)	7

[1] Charles W. Briggs. *Subject Combinations in High School Teachers Programs.* M.A. Thesis. University of Iowa, 1931.

[2] C. W. Ridgway. *A Comparative Study of the Training and Teaching Combinations of Kansas High School Teachers.* Bulletin, Kansas State Teachers College of Emporia, 1931.

high schools of the larger cities. If the large high schools were not included the proportion teaching four or five fields would be greater.

Section B of Table I shows the per cent of physical education teachers who handle physical education alone, according to a number of recent studies. You will note that the per cent ranges from 7 to 31 with an average of less than 20. It would appear that the per cent teaching physical education alone is somewhat higher for women than for men probably owing to the tendency to employ more women than men as specialists in health and physical education.

WHERE are these full-time positions in physical education? Not in the smaller systems where our young graduates go. Miss Gladys Taggart, Director of Physical Education at Wichita University, in a recent study found that only in the larger cities of Kansas, a score or more, is there a demand for women physical education majors for exclusive work in health and physical education. Among cities of the third class she found that seventy-four out of ninety-one have physical education for girls. Only sixteen of the seventy-four small cities have teachers with a major or minor in physical education. In fact, the superintendents in these cities expressed a decided preference for teachers with a minor in physical education who could teach a combination of various subjects.

Turning next to Tables II, III, and IV, let us see what subjects or fields are in most demand in combination with physical education. Tables II and III give data for all high schools in Kansas and Missouri, showing the first, second, and third frequencies of subjects in combination with each major subject-field. (Consult Table II.) Table IV shows the teaching combinations most frequently found with physical education as re-

TABLE II[3]

SUMMARY OF TEACHING COMBINATIONS IN MISSOURI HIGH SCHOOLS
(Based on programs of 2,400 high school teachers outside of Kansas City, St. Louis, and St. Joseph.)

Major Subjects	First in Frequency	Second in Frequency	Third in Frequency
English	Social studies	Latin	Home economics
Social studies	English	Mathematics	Physical Education
Mathematics	Science	Social studies	Latin
Science	Mathematics	Physical Education	Social studies
Physical Education	Social studies	Science	Mathematics
Agriculture	Mathematics	Social studies	Science
Latin	English	Mathematics	Social studies
Home economics	English	Social studies	.....
Commerce	Mathematics	Social studies	.....
Music	English	Social studies	Drawing
Manual training	Physical Education	Agriculture	Science
French	English	Latin	Social studies
Spanish	English	Social studies	Latin

[3] Copied from page 28 of W. W. Carpenter and John Rufi, *The Teacher and the School.* A Syllabus for a Course in High School Administration. University of Missouri, 1929.

ported by five recent studies including the Kansas and Missouri studies just referred to. The social studies and science each ranked first in frequency of combination with physical education in two studies, while industrial arts ranked first in the Kansas study.

TABLE III[4]

SUMMARY OF TEACHING COMBINATIONS IN KANSAS HIGH SCHOOLS, 1930-31

Major Subjects	First in Frequency	Second in Frequency	Third in Frequency
English	Social studies	Latin	Home economics
Social studies	English	Science	Mathematics
Mathematics	Science	Social studies	English
Science	Mathematics	Social studies	Home economics
Physical Education	Industrial arts	Social studies	Science
Agriculture	Science	Industrial arts	Social studies
Latin	English	Social studies	Modern language
Home economics	English	Social studies	Science
Commerce	Social studies	Mathematics	English
Music	English	Social studies	Mathematics
Industrial arts	Science	Physical Education	Mathematics
Modern language	English	Latin	Social studies

[4] Copied from C. W. Ridgway, *A Comparative Study of the Training and Teaching Combinations of Kansas High School Teachers.* Bulletin published by Kansas State Teachers College of Emporia. Table IIa, p. 10.

TABLE IV

TEACHING COMBINATIONS MOST COMMONLY FOUND WITH PHYSICAL EDUCATION AS REPORTED BY VARIOUS STUDIES
(Men and Women)

Order of Frequency	Roemer[5] (1928) Southern States	Briggs[6] (1931) Iowa	Ridgway[7] (1931) Kansas	Carpenter[8] and Rufi (1929) Missouri	Peterson[9] and others (1929) Iowa
1	Science	Soc. studies	Industrial arts	Soc. studies	Science
2	Mathematics	Science	Soc. studies	Science	Soc. studies
3	Soc. science	Mathematics	Science	Mathematics	History
4	Foreign lang.	English	Mathematics	.....	English
5	English	Home econ.	Home econ.	.....	Mathematics

[5] Joseph Roemer. *Secondary Schools of the Southern Association.* United States Bureau of Education Bulletin, No. 16, 1928.
[6] Charles W. Briggs. *Op. cit.*
[7] C. W. Ridgway. *Op. cit.*
[8] W. W. Carpenter and John Rufi. *Op. cit.*
[9] Peterson, Lindquist, Jeep, and Price. *Teacher Supply and Demand in Iowa.* University of Iowa, 1932. p. 169.

By means of a statistical device for combining the rankings of the several studies, it may be shown that the subject combinations most commonly found with physical education for the group of states as a whole are approximately as follows:

1st, Social Studies
2nd, Science
3rd, Mathematics
4th, Industrial Arts
5th, English
6th, Home Economics

Industrial arts and home economics would of course rank higher if combinations for men and women were given separately.

IT SEEMED to the writer that a study of this problem would not be complete without getting the judgments of directors of physical education in state departments of education and in institutions training physical education teachers as to desirable and undesirable teaching combinations. A check list was accordingly sent to fifty-seven directors or professors of physical education, whose names were available. Returns were received from forty-six persons, representing seventeen states largely of the Mid-West but including also Alabama, California, Colorado, Massachusetts, and New York. As to institutions:

19 are in state colleges or universities.
14 are in state teachers colleges.
1 is in a municipal university.
6 are in private colleges and universities.
7 are state directors of physical education.

The directions on the check list read:

"Please place a plus sign (+) in the appropriate column for men, and similarly for women, opposite the five subject-fields which you consider most suitable for teaching combinations with physical education. Likewise place a minus sign (—) opposite any subject-field which you think would not afford a suitable combination."

TABLE V

DESIRABLE AND UNDESIRABLE COMBINATIONS FOR MEN TEACHERS OF PHYSICAL EDUCATION

Recommendations of thirty-seven directors of physical education in colleges, universities, and state departments of education.[10] (Number considering each subject-field desirable or undesirable for men in combination with physical education.)

Subject-Field	Most Desirable	Most Undesirable	Plurality Desirable	Plurality Undesirable
	+	—	+	—
Agriculture	13	8	5	
Art	2	13		11
Biology-Physiology	33	1	32	
Chemistry-Physics	19	7	12	
Commercial branches	10	8	2	
English	5	10		5
Geography	7	5	2	
Health-Hygiene	33	1	32	
History-Social Sciences	25	1	24	
Home Economics	3	11		8
Industrial Education	16	6	10	
Languages	3	12		9
Mathematics	19	6	13	
Music	3	16		13
Public Speaking	8	10		2

[10] Each was requested by the writer to place a plus sign (+) opposite the five subjects considered most desirable for combination with physical education, and a minus sign (—) opposite any which would not afford suitable combination. Read: Agriculture was considered one of the five best combinations by 13 and undesirable by 8, leaving a positive plurality of 5.

Table V gives a summary of the judgments of the directors concerning the suitability of combinations with physical education for men high school teachers. You will note that nine subject-fields received a plurality of positive votes as most desirable for men in the following order of frequency:

1. Biology-physiology	tied	32 each
1. Health-hygiene	tied	32 each
3. History-social sciences		24
4. Mathematics		13
5. Chemistry-physics		12
6. Industrial education		10
7. Agriculture		5
8. Commercial branches	tied	2 each
8. Geography	tied	2 each

Subject-fields receiving a plurality of negative votes, and therefore representing the least desirable combinations for men according to the directors, were in order of frequency:

1. Music	13	(least desirable)
2. Art	11	
3. Languages	9	
4. Home Economics	8	
5. English	5	
6. Public Speaking	2	

TABLE VI

Desirable and Undesirable Combinations for Women Teachers of Physical Education

Recommendations of forty directors of physical education in colleges, universities, and state departments of education.[11] (Number considering each subject-field desirable or undesirable for women in combination with physical education.)

Subject-Fields	Most Desirable	Most Undesirable	Plurality Desirable	Plurality Undesirable
	+	—	+	—
Agriculture	1	16		15
Art	10	11		1
Biology-Physiology	34	2	32	
Chemistry-Physics	10	9	1	
Commercial branches	6	8		2
English	19	6	13	
Geography	5	5	..	..
Health-Hygiene	38	1	37	
History-Social Science	25	1	24	
Home Economics	22	5	17	
Industrial Education	4	13		9
Languages	7	11		4
Mathematics	9	11		2
Music	24	6	18	
Public Speaking	17	8	9	

[11] For explanations see footnote to Table V.

Similarly, Table VI gives data concerning the suitability of various combinations with physical education for women high school teachers. Eight subject-fields received a plurality of positive votes as most desirable combinations for women as follows:

1. Health-hygiene	37
2. Biology-physiology	32
3. History-social sciences	24
4. Music	18
5. Home Economics	17
6. English	13
7. Public Speaking	9
8. Chemistry-physics	1

Six subject-fields received a plurality of negative votes as the least desirable combinations for women in the following order of frequency:

1. Agriculture	15	(least desirable)
2. Industrial education	9	
3. Languages	4	
4. Commercial branches	same 2	
4. Mathematics	same 2	
6. Art	1	

Please note by comparing Tables V and VI that health-hygiene, biology-physiology, and history-social sciences were ranked as the three best combinations, for both men and women teachers of physical education; that fourth and fifth rank were given to mathematics and chemistry-physics for men and to music and home economics for women; and that agriculture, art, commercial branches, geography, languages, and public speaking were ranked low for both men and women.

SUGGESTIONS and explanations accompanying the check-list have helped materially to interpret the findings of the study. The chief objection to certain subjects seems to be that they require *so much time* on the part of the teacher that they interfere with the physical education program. Subjects especially objected to on this account are art, chemistry-physics, and industrial education. Other subjects falling under the same indictment to a lesser degree are: agriculture, English, languages, music, and public speaking. Some of these subjects no doubt require after-school work which would conflict with physical education extra-curricular activities. One of the state supervisors of physical education apparently voiced the feelings of many directors as to the time difficulty when he wrote, "A physical education teacher needs to be free for extensive service after school as well as during school."

Another point of view voiced by several directors in their comments is that other factors, such as personality, interest, and types of training, must determine combinations to a large extent. As one put it, "All of these subjects are suitable if the person is qualified. Most suitable means nothing except in terms of qualification."

The fact still remains, however, that some subject fields, such as agriculture, art, and commerce involve so much highly specialized training that they offer fewer possibilities as suitable combinations than some subjects which enter into the general training of the physical education major or which do not require as extensive technical training. A director of physical education in one of the large state universities of the Middle West expressed my own views so clearly in her comments that I am going to take the liberty of quoting briefly from her letter:

"My opinion on advisable teaching combinations is based largely on a philosophy of education which is concerned primarily with the growth of the individual. I feel that it is inadvisable to set up an inflexible program of professional preparation in physical education and one or more specified teaching combinations. I feel that we must all allow room in our professional courses for enough electives so that the individual student will be able to follow his interests to the point of certain subject concentrations along other lines.

"In general, I should say that highly technical fields which do not have basic content common to physical education would be less advisable for subject combinations than less technical studies. I feel, for instance, that commercial branches, art, literature, and possibly home economics are of doubtful value as subject combinations with physical education.

"In regard to home economics, may I say that it, like physical education, has a number of technical courses. Both subjects, however, have a common science foundation: chemistry, biology, physiology, nutrition, hygiene, etc. Moreover, the subject combination is a favorite one with school administrators for some obscure reason. Therefore, I think that the physical educator would be wise to look into the possibility of combining home economics and physical education as subjects of specialization."

BEFORE proceeding to other phases of the problem, let us compare briefly the recommendations of the directors of physical education with the findings of Table IV as to the combinations most commonly found with physical education. There appears to be rather close agreement for the most part.

Teaching Combinations Most Commonly Found With Physical Education	Combination Considered Most Desirable by Directors of Physical Education	
Order of Frequency:	*For Men*	*For Women*
1st. Social Studies	Biology-Physiology	Health-hygiene
2nd. Science	Health-hygiene	Biology-Physiology
3rd. Mathematics	History-Soc. Science	History-Soc. Science
4th. Industrial Arts	Mathematics	Music
5th. English	Chemistry-physics	Home Economics
6th. Home Economics	Industrial Education	English

Turning now to Tables VII and VIII we find some pertinent data regarding the extent to which Kansas high school teachers in general and the physical education teachers in particular are teaching subjects in which they have not made special preparation. Table VII indicates that 48 per cent of all teachers in Kansas high schools are teaching one or more subjects, and 24 per cent are teaching two or more subjects without train-

ing to the extent of a major or minor in such subjects. The significant fact brought out by Table VIII is that, in general, teachers of physical education in Kansas are much less likely to have a major or minor in physical education than in the subject field which they combine with physical education for teaching purposes.

TABLE VII[12]

SUBJECTS TAUGHT WITHOUT COLLEGE TRAINING BY KANSAS HIGH SCHOOL TEACHERS. 1930-31

52 per cent	taught no subject in which they had not majored or minored
24 per cent	taught one subject in which they had not majored or minored
12 per cent	taught two subjects in which they had not majored or minored
4 per cent	taught three subjects in which they had not majored or minored
8 per cent	did all their teaching in fields in which they had not majored or minored

[12] Adapted from Ridgway, *Op. cit.*, p. 14.

TABLE VIII[13]

PHYSICAL EDUCATION TEACHERS, COMBINATIONS AND TRAINING. KANSAS HIGH SCHOOLS, 1930-31

Read table thus: 56 teachers, or 22 per cent of all physical education teachers, taught nothing but physical education. Seventy-nine per cent of this 22 per cent had a college major or minor in physical education. Eleven teachers, or 4 per cent of all physical education teachers, taught a combination of physical education and English. Ninety-one per cent of this 4 per cent who taught a combination of physical education and English had a major or minor in English, while 18 per cent of this 4 per cent had a major or minor in physical education.

56, or 22 per cent,	taught Phys. Educ. alone	79% had training in P. E.
11, or 4 per cent,	taught Phys. Educ. and English	91% had training in Eng. 18% had training in P. E.
29, or 11 per cent,	taught Phys. Educ. and Math.	66% had training in Math. 21% had training in P. E.
50, or 20 per cent,	taught Phys. Educ. and So. Sci.	82% had training in So. Sc. 28% had training in P. E.
29, or 11 per cent,	taught Phys. Educ. and Science	86% had training in Sci. 41% had training in P. E.
50, or 20 per cent,	taught Phys. Educ. and Ind. Arts	70% had training in Ind. A. 40% had training in P. E.
13, or 5 per cent,	taught Phys. Educ. and Home Ec.	85% had training in H. Ec. 23% had training in P. E.
9, or 5 per cent,	taught Phys. Educ. and Com.	67% had training in Com. 44% had training in P. E.
2, or 1 per cent,	taught Phys. Educ. and Agri.	50% had training in Agri. 50% had training in P. E.
3, or 1 per cent,	taught Phys. Educ. and Music	100% had training in Music 0% had training in P. E.

[13] Adapted from Ridgway, *Op. cit.*, p. 21.

Table X shows that physical education teachers of Kansas stand at the bottom of the list of the various subject fields as to the per cent who have a major or minor in their respective fields. Home economics stands highest with 90 per cent of majors or minors as compared with 42 per cent for physical education with English second with 88 per cent and music third with 84 per cent.

TABLE IX[14]

DISTRIBUTION OF IOWA HIGH SCHOOL TEACHERS OF PHYSICAL EDUCATION WITH RESPECT TO DOMINANCE OF PHYSICAL EDUCATION IN THEIR TEACHING PROGRAMS (1928-29)

Physical Education	Number	Per Cent of 977
Only Dominance	81	8
1st Dominance	291	30
2nd Dominance	351	36
3rd Dominance	254	26
Totals	977	100

[14] Adapted from Peterson, Lindquist, Price, and Jeep, *Op. cit.*, p. 84.

TABLE X[15]

KANSAS HIGH SCHOOL TEACHERS WITH A MAJOR OR MINOR IN THEIR TEACHING FIELDS. 1930-31

Subject Fields	Number of Teachers	Per cent who have major or minor in field	Per cent who teach in this field alone
English	1,029	88%	29%
Mathematics	682	68%	20%
Social Science	1,022	74%	25%
Science	751	71%	15%
Latin	313	64%	8%
Modern language	191	76%	16%
Industrial arts	348	70%	26%
Home economics	539	90%	32%
Commerce	522	65%	58%
Agriculture	240	60%	27%
Music	449	84%	61%
Physical education	252	42%	22%

[15] Adapted from Ridgway, *Op. cit.*, p. 15.

The conditions in Kansas illustrate what is likely to happen in a state with a large number of small high schools in the absence of proper state certification requirements. Kansas has an unusually large proportion of small high schools, but I suspect that similar conditions as to lack of training are found in many other states. In fact, studies by Earl W. Anderson in Ohio, and by others bear out this statement. In explanation of the fact that so many graduates make no direct use of their major training and contrariwise teach so many subjects for which they had no major preparation, Dr. Anderson said:

"This situation came about in most instances probably because the graduate was unable to obtain any position teaching classes in his major subject. It may also have happened because the school authorities were unable to find teachers who were well prepared in the subjects which were to be taught. The situation is probably accentuated by the disinterest of some school authorities in getting people with *specific preparation* for the subjects to be taught; by local pressure for the appointment of certain graduates regardless of their preparation; by the assumption of some admin-

istrators that personality is worth more than specific training when a choice must lie between the two. . . . It is probable that such assignment of teachers without regard to their specific major preparation will continue until state requirements definitely forbid it."[16]

I agree with Dr. Anderson that the proper way to eradicate the evil is to set up certification standards requiring all teachers to have special preparation for the subjects they are to teach. If this were done, there would be no surplus of teachers. It would seem that well prepared teachers of physical education are more in need of such protection than are teachers in any other subject field. Is it not high time that we as educators bestirred ourselves to secure saner regulations for the certification of teachers? Some states have made marked progress in this matter, but the standards in most states are still *woefully inadequate.*

IT IS not the purpose of this paper to set up a curriculum for the training of teachers of physical education but I cannot refrain from making a few suggestions which seem pertinent to our topic. Curricula for the training of teachers are, it seems to me, in many cases in need of considerable revision. This is true of those designed for training academic teachers as well as of those for special fields. In general I believe that teacher-training curricula should be built upon the following principles:

1. A large part of the first two years should be devoted to giving the student a broad general training in the main fields of human endeavor including an understanding of modern problems, social, economic, and political. Broad survey courses of the kind now being given at the University of Chicago and many other institutions should form the cultural background for all types of teachers. Our special curricula too frequently have turned out narrow specialists who are not educated in the true sense of the term.

2. Specialization should not ordinarily begin until the third year. Many students are now entering upon specialized courses without sufficient foundational training to enable them to make a wise choice of either major or minor fields. Why would it not be better to defer the selection of major and minors until the end of the second year? This may mean leaving some of the advanced technical courses for graduate work, but I am convinced that a fifth year is very desirable especially in curricula involving as much highly technical training as is found in industrial education, home economics, and physical education. Students might be permitted to teach in the smaller schools on four years of training but be expected to take a fifth year of specialized training before qualifying as a special teacher in the field.

3. The student should be required to complete two minors in addition to a major. A broad range of fields should be permitted so as to allow the

[16] Earl W. Anderson. "Graduates and Positions They Fill," *Educational Research Bulletin,* Vol. 10, No. 4, Ohio State University.

student to work in fields in which he has the greatest interest and aptitude. At the same time he should be informed that certain subjects ordinarily afford better teaching combinations than others.

4. The number of credits required for a major or minor should vary somewhat according to the demands of the field and also in accordance with the standards of the various accrediting agencies. In this section of the country the standards of the North Central Association, which call for a minimum of fifteen semester hours in most of the teaching fields, should be carefully observed. General courses of the first two years should be counted toward the major or minors in their respective fields.

5. Subjects making up the minors should be selected under careful guidance so as to afford the maximum preparation for high school teach-

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The following table gives information of a similar nature to the previous tables and is from data furnished by E. W. Everts, State Director of Physical and Health Education, St. Paul, Minnesota.

A Study of the Training of Teachers Now Teaching Physical Education in High Schools of Minnesota
(Major Training)

Majors	Number teaching Physical Education a certain number of periods						Totals	Per Cent of 703
	1	*2*	*3*	*4*	*5*	*6*		
Physical Education	5	7	12	17	28	104	173	25.1
History	63	14	9	2	2	4	94	13.0
English	61	11	1	1		2	76	11.0
Home Economics	45	5					50	7.0
Industrial Arts	29	10	2				41	6.0
Mathematics	28	6	4		2		40	6.0
Chemistry	25	8	2	1	1		37	5.0
Biology	17	3		1		3	24	3.0
General Science	16	5	1	1		1	24	3.0
Social Science	10	6	3			1	20	3.0
Physics	9	1	2	1	1		14	2.0
Latin	9	4					13	2.0
Economics	4	6	1	1			12	2.0
Zoology	4	3		1			8	1.0
French	3	2	1	1			7	1.0
Agriculture	5				1		6	1.0
Commerce	2	1			1	1	5	Less than 1
Education	2	2	1	1			5	Less than 1
German	2					2	4	Less than 1
Music	2		1	1			4	Less than 1
Botany	3						3	Less than 1
Political Science	2	1					3	Less than 1
Sociology	1	1				1	3	Less than 1
Spanish	1				1		2	Less than 1
Geology						1	1	Less than 1
Speech							1	Less than 1
Admin. and Super.....		1					1	Less than 1
No Report	9	3	3	5	2	10	32	
Totals	357	100	43	33	39	131	703	
Per cent of 703.	50.8	14.2	6.1	4.7	5.5	18.6	100.	

ing in the given fields within the limited number of hours. My experience has been that less attention is given to the planning of minor than to major programs, whereas the reverse should probably be the general rule. It seems to me that the cause of physical education as well as of education in general will be strengthened by setting up carefully planned minors of fifteen to twenty hours in physical education and encouraging promising students looking forward to high school teaching to include a minor in physical education. Have we not too often in our higher institutions overlooked the importance of the minors in our efforts to build up strong majors?

THE findings of this study would seem to warrant the following conclusions:

1. While it is probably not desirable to restrict the majors or minors to be combined with physical education to a few closely related subject-fields, the students should understand that certain combinations are more in demand than others.

2. Since the large majority of inexperienced teachers must begin work in the smaller schools where the probabilities are that they will have to teach in at least three fields, all four-year teacher-training curricula should require two minors in addition to a major.

3. The most satisfactory subject fields for major or minor combinations with physical education would seem to be

(*a.*) For men: Biology-physiology, health-hygiene, history-social sciences, mathematics, chemistry-physics, and industrial education.

(*b.*) For women: Health-hygiene, biology-physiology, history-social sciences, music, home economics, English, and public speaking.

4. Certification standards should be such that teachers will be required to have a reasonable degree of preparation for all subjects which they teach.

5. Continuous study should be made in all the states of the various problems relating to supply and demand so as to produce a better balance between the teacher-preparation programs and the needs of the public schools.

A Report on Teaching Combinations in Physical Education in the High Schools of Illinois

For Men and Women

By Clifford E. Horton,
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THE RAPID growth of physical education in the public schools of Illinois has brought about a tremendous increase in the demands for teachers in this field from teacher-preparation institutions. These demands, however, have not been constant. A few years ago the man who was prepared to teach manual arts and coach athletics was considered to have a better than average chance of securing a position. Today the situation is markedly changed. Practically every field of education is found combined with that of physical education and the question of selecting suitable teaching combinations, with physical education as either the first or second teaching field, is a complex one.

Positions in Illinois are, for the most part, combination positions requiring two or three subjects in addition to physical education. Physical education (or coaching) rarely occurs alone except in the larger cities. The problem confronting teacher-preparation institutions, therefore, is to provide adequate curricula for the training of teachers in one or more fields in addition to physical education and to provide for a few highly trained individuals in physical education for the less frequent demands from the larger centers of population.

The extent to which a teacher-preparation institution can go in providing instruction in other fields is an administrative problem of considerable consequence but it seems probable that it should be limited to two or three fields where there is the greatest likelihood of demand for teachers.

Just what these demands will be is problematical since there are no reliable data upon the subject. There are, however, the experiences of placement bureaus that may be used until more reliable data can be produced. In addition to this, the positions published in the high school directory offer valuable information relative to the actual combinations now being taught in connection with physical education throughout the state.

At the Illinois State Normal University statements issued by the Bureau of Appointments concerning the most desirable combinations of teaching fields led to the question as to whether these combinations held for the area normally supplied with teachers by this institution, consisting of twenty-seven counties in the central portion of the state, and for the state generally, exclusive of Chicago. As the only available means of securing this information was to classify the positions listed in the *Illinois State High School Directory,* it was decided to use this medium as the basis for a study of this problem.

Positions in Chicago were omitted because they are, for the most part, located in schools considerably larger than those generally filled by graduates from the teachers colleges and consequently could not be considered as representative of the demands made upon the placement bureaus of these institutions.

Persons engaged in physical education work in Illinois are recruited mostly from colleges located in the Middle West, though Hanson reports a total of 103 different schools from various parts of the country as supplying these positions. Of these, the University of Illinois ranks first and the Illinois State Normal University second, supplying approximately one-third and one-ninth of the total number of positions respectively.[1]

PROCEDURE

All of the positions listed in the directory where any phase of physical education was indicated either alone or in combination with other subjects, were recorded on cards to facilitate checking in each teaching field. Lists were made for both men and women containing the titles of all courses together with the frequency of their occurrence. The titles of positions such as coach, athletic director, etc., were also listed in the order of their numerical importance and included in a general tabulation for each group to show diversity, terminology, and frequency.

Next, all data relating to positions for men were classified under eleven different heads as follows: (1) physical education, (2) science, (3) history and social science, (4) mathematics, (5) commerce, (6) manual arts, (7) administration, (8) English, foreign language, and speech, (9) agriculture, (10) music, (11) miscellaneous.

The types of positions occupied by women were arranged under twelve different heads as follows: (1) physical education, (2) English and foreign language, (3) science, (4) history and social science, (5) home economics, (6) commercial, (7) mathematics, (8) music, (9) administrative positions, (10) library, (11) art, (12) miscellaneous.

[1] Raymond Willis Hanson. "Physical Education, Hygiene, and Athletic Administration in Public High Schools of Illinois," *Western Illinois State Teachers College Quarterly,* Macomb, Illinois (December 1931).

From this arrangement, the frequency of occurrence in each field was obtained.

The third step was to rate teaching combinations in each of the seven leading fields for men and five for women, to show the frequency with which each separate field occurred in combination with physical education and with other subjects.

As a final step the best combinations of subjects with physical education were selected on the basis of the frequency of their occurrence together. To this has been added the statements of the Bureau of Appointments of the Illinois State Normal University and those of A. W. Clevenger and L. W. Williams of the University of Illinois, both based on experience with the field.

The accompanying tables show the results of the study and at least offer an indication as to the possible solution of the problem of deciding upon suitable combinations of teaching fields with physical education in Illinois.

TABLE I

DISTRIBUTION OF TEACHING AND OTHER DUTIES, AND THE FREQUENCY OF THEIR OCCURRENCE, OF MEN ENGAGED IN PHYSICAL EDUCATION IN 674 POSITIONS IN THE HIGH SCHOOLS OF ILLINOIS OUTSIDE THE CITY OF CHICAGO.

Coach	322	Zoology	4
Athletics	172	Arithmetic	4
Physical Education	125	Typewriting	4
Mathematics	125	Botany	4
History	116	Superintendent	4
Science	107	Band	3
Manual Arts	70	Physical Geography	3
Physics	60	Physical Culture	3
Physical Training	53	Sociology	2
Biology	51	Biological Science	2
General Science	42	Vocational	2
Principal	39	Gymnasium	2
Social Science	36	Ass't Phys. Education	2
Economics	35	Swimming	2
Civics	30	Shorthand	1
Commerce	29	Chorus	1
Physiology	28	Debate	1
Algebra	26	Citizenship	1
English	26	Public Speaking	1
Assistant Coach	26	Education	1
Agriculture	25	Orchestra	1
Geometry	23	Intramural Manager	1
Bookkeeping	17	Business	1
Athletic Director	17	Music	1
Commercial Arithmetic	11	Assistant Athletics	1
Physical Ed. Director	10	Ass't Superintendent	1
Commercial Geography	10	Building Trade	1
Latin	10	Study Hall	1
Geography	9	Business Training	1
Commercial Law	7	Shop	1
Chemistry	6	Manager of Athletics	1
Political Science	6	Phys. Ed. Coach	1
Assistant Principal	6	Intramural Athletics	1
Physiography	5	Crippled Children's Class	1
Mechanical Drawing	4	Ath. Director of Social Center	1

TABLE II

TITLES OF INSTRUCTORS AND COURSES TAUGHT BY MEN ENGAGED IN PHYSICAL EDUCATION IN 674 POSITIONS IN THE HIGH SCHOOLS OF ILLINOIS OUTSIDE THE CITY OF CHICAGO, GROUPED IN TEACHING FIELDS AND ADMINISTRATION.

Physical Education

Coach	322	Ass't in Phys. Ed.	2
Athletics	172	Swimming	2
Physical Education	125	Phys. Ed. Coach	1
Physical Training	53	Manager of Athletics	1
Assistant Coach	26	Ass't in Athletics	1
Athletic Director	17	Intramural Manager	1
Phys. Ed. Director	11	Intramural Athletics	1
Physical Culture	3	Ath. Dir. Soc. Center	1
Gymnasium	2		

Science

Science	107	Physical Science	6
Physics	60	Zoology	4
Biology	51	Botany	4
General Science	42	Physiography	5
Physiology	28	Physical Geography	3
Geography	9	Biological Science	2
Chemistry	6		

History and Social Science

History	116	Civics	30
Social Science	36	Sociology	2
Economics	35	Citizenship	1

Mathematics

Mathematics	125	Geometry	23
Algebra	26	Arithmetic	4

Commerce

Commerce	29	Typewriting	4
Bookkeeping	17	Shorthand	1
Commercial Arithmetic	11	Business	1
Commercial Geography	10	Business Training	1
Commercial Law	7		

Manual Arts

Manual Arts	70	Building Trade	1
Mechanical Drawing	4	Shop	1
Vocational	2		

Administration

Principal	39	Superintendent	4
Assistant Principal	6	Ass't Superintendent	1

English and Foreign Language

English	26	Debate	1
Latin	10	Public Speaking	1

Agriculture

Agriculture	25		

Music

Band	3	Orchestra	1
Chorus	1	Music	1

Miscellaneous

Education	1	Study Hall	1
Crippled Children's Class	1		

The title "Physical Education" is used to designate all positions where any phase of this subject is taught in the following table. This is done in order to prevent differentiation within the field.

In this table the data have been divided into two parts. In the first column, the figures indicate the number of times each combination occurs outside the territory of the Illinois State Normal University. The second column indicates the number of times each combination occurs within the twenty-seven counties which this school normally supplies with teachers. The third column indicates the total for the state, exclusive of Chicago.

TABLE III

Science

	1	2	3
Science and Physical Education	67	35	102
Science, Mathematics, and Physical Education	36	32	68
Science, Social Science, and Physical Education	29	12	41
Science, Manual Arts, and Physical Education	9	3	12
Science, Commerce and Physical Education	7	4	11
Science, Agriculture, and Physical Education	3	5	8
Science, English, Foreign Language, and Physical Education	3	1	4
Science, Music, and Physical Education	2	1	3
Totals	156	93	249

History and Social Science

Social Science and Physical Education	57	30	87
Social Science, Science, and Physical Education	30	13	43
Social Science, Mathematics, and Physical Education	11	10	21
Social Science, English, and Physical Education	8	2	10
Social Science, Commerce, and Physical Education	6	3	9
Social Science, Manual Arts, and Physical Education	3	3	6
Social Science, Agriculture, and Physical Education	1	0	1
Social Science, Latin, Physical Education	1	0	1
Social Science, Music, Physical Education	1	1	2
Social Science, Science, Agriculture, and Physical Education	0	1	1
Totals	118	63	181

Mathematics

Mathematics, and Physical Education	45	19	64
Mathematics, Science, Physical Education	31	28	59
Mathematics, Social Science, Physical Education	9	8	17
Mathematics, Commerce, Physical Education	4	0	4
Mathematics, Manual Arts, Physical Education	3	3	6
Mathematics, Science, Music, Physical Education	2	1	3
Mathematics, Social Science, Commerce, Physical Education	2	0	2
Mathematics, Agriculture, Physical Education	2	0	2
Mathematics, Science, English, Physical Education	1	0	1
Mathematics, Social Science, Science, Physical Education	1	0	1
Mathematics, Science, Agriculture, Physical Education	1	0	1
Mathematics, Social Science, Agriculture, Physical Education	1	0	1
Mathematics, Commerce, Agriculture, Physical Education	1	0	1
Mathematics, Speech, Physical Education	2	0	2
Mathematics, Commerce, Physical Education	0	2	2
Mathematics, Latin, Physical Education	0	1	1
Totals	105	62	167

TABLE III (*Continued*)

Manual Arts

Manual Arts and Physical Education	39	16	55
Manual Arts, Science, Physical Education	5	2	7
Manual Arts, Mathematics, Physical Education	3	3	6
Manual Arts, Social Science, Physical Education	3	3	6
Manual Arts, Agriculture, Physical Education	3	1	4
Manual Arts, Science, Commerce, Physical Education	0	2	2
Manual Arts, Science, Mathematics, Physical Education	1	0	1
Totals	54	27	81

Commerce

Commerce and Physical Education	21	11	32
Commerce, Science, Physical Education	7	4	11
Commerce, Social Science, Physical Education	6	3	9
Commerce, Mathematics, Physical Education	6	2	8
Commerce, Manual Arts, Physical Education	1	1	2
Commerce, Latin, Physical Education	1	0	1
Commerce, Science, Mathematics, Physical Education	0	2	2
Commerce, English, Physical Education	0	3	3
Commerce, Public Speaking, Physical Education	0	1	1
Totals	42	27	69

Agriculture

Agriculture and Physical Education	2	3	5
Agriculture, Science, Physical Education	4	4	8
Agriculture, Science, Mathematics, Physical Education	1	0	1
Agriculture, Science, Social Science, Physical Education	0	2	2
Agriculture, Social Science, Mathematics, Physical Education	1	0	1
Agriculture, Manual Arts, Physical Education	2	0	2
Agriculture, Mathematics, Commerce, Physical Education	2	0	2
Agriculture, Science, Manual Arts, Physical Education	1	0	1
Agriculture, Mathematics, Physical Education	2	0	2
Totals	15	9	24

English

English and Physical Education	4	0	4
English, Science, Physical Education	2	1	3
English, Science, Mathematics, Physical Education	1	0	1
English, Social Science, Physical Education	8	0	8
English, Manual Arts, Physical Education	0	1	1
English, Latin, Physical Education	3	0	3
English, History, Physical Education	0	2	2
Totals	18	4	22

TABLE IV

BEST COMBINATION OF SUBJECTS WITH PHYSICAL EDUCATION AS THE FIRST TEACHING FIELD

(1) Based on an analysis of 674 positions in the high schools of Illinois.

Physical Education, Science, and Mathematics.

(2) Based on positions in 27 counties in the district allotted to the Illinois State Normal University.

Physical Education, Science, and Mathematics.

(3) Based on the demands for teachers from the Illinois State Normal University Bureau of Appointments.

Physical Education, Mathematics, and Science.

(4) Based on the experience of demands at the University of Illinois (by A. W. Clevenger and L. W. Williams)

Physical Education (Health Education), Mathematics, Social Science.

TABLE V

DISTRIBUTION OF TEACHING AND OTHER DUTIES, AND THE FREQUENCY OF THEIR OCCURRENCE, OF WOMEN ENGAGED IN PHYSICAL EDUCATION IN 292 POSITIONS IN THE HIGH SCHOOLS OF ILLINOIS OUTSIDE THE CITY OF CHICAGO.

Physical Education	95	Sewing	3
English	63	Dean of Girls	3
Physical Training	51	Physical Culture	2
Home Economics	27	Commercial Geography	2
Latin	24	Hygiene	2
History	22	Foods	2
Mathematics	22	Librarian	2
Athletics	15	Principal	2
Biology	14	Physical Director	1
Music	13	Girls Ath. Director	1
Commercial	11	Director of Health	1
Science	11	Health	1
French	9	Public Speaking	1
Algebra	9	Foreign Language	1
General Science	8	Chorus	1
Bookkeeping	7	Orchestra	1
Social Science	7	Instrumental Music	1
Civics	6	Dramatic Art	1
Gymnasium	5	Art	1
Typing	4	Business Subjects	1
Commercial Arithmetic	4	Elementary Science	1
Dramatics	4	Smith Hughes Home Ec.	1
Economics	4	Smith Hughes Dom. Sci.	1
Clothing	4	Cooking	1
Clothing	4	Library	1
Geometry	4	Geography	1
Commercial Law	3	Physiography	1
Phys. Ed. Director	3	Matron	1
Swimming	3	Study Hall	1
Shorthand	3	School Nurse	1
Domestic Science	3	Social Center Work	1

TABLE VI

TITLES OF INSTRUCTORS AND COURSES TAUGHT BY WOMEN ENGAGED IN PHYSICAL EDUCATION IN 292 POSITIONS IN THE HIGH SCHOOLS OF ILLINOIS OUTSIDE THE CITY OF CHICAGO, GROUPED IN TEACHING FIELDS AND ADMINISTRATION.

		Physical Education	
With other subjects	210	Swimming	3
Physical Ed. alone	95	Physical Culture	2
Physical Training	51	Physical Director	1
Athletics	15	Girls Athletic Director	1
Gymnasium	5	Director of Health	1
Phys. Ed. Director	3	Health	1
		English and Foreign Language	
English	63	Public Speaking	1
Latin	24	Foreign Language	1
French	9	Dramatic Art	1
Dramatics	4		
		Science	
Biology	14	Hygiene	2
Science	11	Elementary Science	1
Physiology	10	Geography	1
General Science	8	Physiography	1
		History and Social Science	
History	28	Civics	6
Social Science	7	Economics	4
		Home Economics	
Home Economics	27	Foods	2
Clothing	4	Smith Hughes Home Ec.	2
Domestic Science	3	Smith Hughes Dom. Sci.	1
Sewing	3	Cooking	1
		Commercial	
Commercial	11	Commercial Law	3
Bookkeeping	7	Shorthand	3
Typing	4	Commercial Geography	2
Commercial Arithmetic	4	Business Subjects	1
		Mathematics	
Mathematics	22	Geometry	4
Algebra	9		
		Music	
Music	13	Orchestra	1
Chorus	1	Instrumental Music	1
		Administrative Positions	
Dean of Girls	3	Principal	2
		Library	
Librarian	2	Library	1
		Art	
Art	1		
		Miscellaneous	
School Nurse	1	Matron	1
Study Hall	1	Social Center Work	1

In this table the data have been divided into two parts. In the first column, the figures indicate the number of times each combination occurs outside the territory of the Illinois State Normal University. The second column indicates the number of times each combination occurs within the twenty-seven counties which this school normally supplies with teachers. The third column indicates the total for the state, exclusive of Chicago.

TABLE VII

Rating of Teaching Combinations with Physical Education

	1	2	3
English			
English and Physical Education	15	5	20
English, Latin, and Physical Education	6	1	7
English, Home Economics, Physical Education	5	2	7
English, Music, Physical Education	4	1	5
English, Science, Physical Education	4	0	4
English, Mathematics, Physical Education	2	2	4
English, Commerce, Physical Education	2	1	3
English, Latin, Mathematics, Physical Education	1	0	1
English, Latin, Music, Physical Education	1	0	1
English, Dramatics, Physical Education	2	0	2
English, Social Science, Science, Physical Education	1	0	1
English, History, Physical Education	1	3	4
English, Latin, Commerce, Physical Education	0	1	1
English, French, Physical Education	0	1	1
English, Public Speaking, Physical Education	0	1	1
English, Home Economics, Dramatics, Physical Education	0	1	1
English, History, Dramatics, Physical Education	0	1	1
Total	44	20	64
Science			
Science and Physical Education	10	5	15
Science, Home Economics, Physical Education	6	3	9
Science, Social Science, Physical Education	5	0	5
Science, English, Physical Education	4	0	4
Science, Mathematics, Physical Education	3	0	3
Science, Latin, Physical Education	2	0	2
Science, Social Science, English, Physical Education	1	0	1
Science, French, Physical Education	1	0	1
Science, Music, Physical Education	1	0	1
Science, Mathematics, Home Economics, Physical Education	0	1	1
Totals	33	9	42
Home Economics			
Home Economics and Physical Education	7	7	14
Home Economics, Science, Physical Education	7	3	10
Home Economics, Commerce, Physical Education	1	3	4
Home Economics, Commerce, History, Physical Education	0	2	2
Home Economics, English, Physical Education	5	1	6
Home Economics, Mathematics, Gen. Science, Phys. Education	0	1	1
Home Economics, Foreign Language, Physical Education	0	1	1
Home Economics, History, Physical Education	2	0	2
Totals	22	18	40
History and Social Science			
History, Social Science, Physical Education	5	4	9
History, Social Science, Science, Physical Education	4	0	4
History, Latin, Physical Education	3	4	7
History, Home Economics, Physical Education	2	0	2
History, Commerce, Physical Education	1	0	1
History, Civics, Science, English, Physical Education	1	0	1
History, Social Science, English, Physical Education	1	3	4
History, French, Physical Education	1	0	1

TABLE VII (*Continued*)

History and Social Science (*Continued*)

History, Home Economics, Commercial, Physical Education	0	3	3
History, Librarian, Physical Education	0	1	1
History, Mathematics, Physical Education	0	1	1
History, English, Dramatics, Physical Education	0	1	1
Totals	18	17	35

Mathematics

Mathematics, and Physical Education	14	4	18
Mathematics, Science, Physical Education	3	0	3
Mathematics, English, Physical Education	2	2	4
Mathematics, English, Latin, Physical Education	1	0	1
Mathematics, Commerce, Physical Education	0	4	4
Mathematics, Latin, Physical Education	1	1	2
Mathematics, Commerce, French, Physical Education	0	1	1
Mathematics, History, Physical Education	0	1	1
Totals	21	13	34

TABLE VIII

BEST COMBINATION OF SUBJECTS WITH PHYSICAL EDUCATION

(1) Based on analysis of 292 positions in the high schools of Illinois, excluding Chicago.

English, Latin, Physical Education or English, Home Economics, Physical Education

(2) Based on positions in the twenty-seven counties in the district allotted to the Illinois State Normal University.

Home Economics, Science, Physical Education

(3) Based on demands for teachers from the Illinois State Normal University Bureau of Appointments.

Home Economics, Social Science, English or Mathematics, and Physical Education.

(4) Based on the experience of A. W. Clevenger and L. W. Williams of the University of Illinois.

Health Education (Women). (1) Biology, (2) Social Science, (3) Home Economics.

CONCLUSIONS

1. The duties of teachers of physical education cover a wide range of academic subjects although in many cases the combinations are rare. Most of the combinations center around mathematics, history and social science, science, and manual arts for men; and English, Latin, home economics, history and social science, mathematics, and science for women.

2. Many positions are listed in which physical education is the second or third teaching field. This apparently indicates the desirability for teacher-preparation institutions to offer suitable curricula so that students in other fields who show promise for physical education may be adequately prepared to meet the demands to fill such positions.

3. Teacher-preparation institutions should distribute their prospective teachers, as much as possible, throughout the various teaching fields indicated above in order to prevent an oversupply in any given field. It

is suggested that students taking a first teaching field in physical education be limited to two other fields and that students be selected from other fields to take their second teaching field in physical education. This would broaden the fields in which demands could be met and at the same time hold up the standards of preparation.

4. There is no uniform title applied to men engaged in this work though there is a strong preference for the title "Coach." While this title may be indicative of the chief duties of persons employed there is no direct evidence that the coach does not supervise the entire physical education program nor that the schools of the state are failing to comply with the law regarding the requirements in this field.

5. The title "physical education" is quite generally used in positions for women and in many cases is given as the entire teaching duties of persons employed in schools irrespective of size.

6. In Illinois, the best teaching combination for men is: science, mathematics, and physical education. This is shown in the data collected from 674 positions distributed over the state exclusive of Chicago. It is shown in the data collected from the 27 counties in central Illinois supplied by the Illinois State Normal University, and it is supported by the statements of the Bureau of Appointments from this institution. It is at slight variance with the statement of the placement bureau of the University of Illinois.

7. That this preference for a limited number of combinations with other subjects is not purely local is indicated by somewhat similar findings at Syracuse University, based on experience with the field in New York state and reported by Andreas. He states that the demands were principally in five fields as follows: social science, business education, mathematics, science, and history. He also states that in interviews with "fifty-two high school principals and superintendents in central New York to determine the type of training they preferred for the director of physical education—all favored a preparation fitting one to teach an academic subject as well as physical education," and that "in 75 per cent of the cases a definite preference for a coach was indicated."[2]

[2] Lewis P. Andreas. "Double-Major Programs in Teacher Training in Physical Education." RESEARCH QUARTERLY (March, 1933), p. 78. ff.

Group Progress of White and Colored Children in Learning a Rhythm Pattern

By Dorothy M. Muzzey
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MANY students of the negro race have in their writings expressed the opinion that a superior sense of rhythm is one of the marked characteristics of the group.* The black man is believed to be, by nature, highly sensitive to music, rhythm, and dancing.

Observations of the colored people in the cotton fields of the South impress one with the place of rhythm in the daily life of the negro. Work is carried on under the stimulus of songs, with movements of the body fitted to the rhythm of the chant. In such occupations as stake driving in a circus, colored men are preferred to whites because of their ready adaptation to the rhythmic swing of the mauls and nicely timed release of energy which makes for effectiveness in this task.

The common belief in the superior sense of rhythm of the negro and the experience the writer has had in teaching rhythmic activities to colored girls, led to the selection of a problem involving comparative learning of white and colored groups in rhythm.

In the reports of studies of rhythm one finds:

1. In general the laboratory tests have made use of the accessory muscle groups, such as the finger muscles. The fundamental muscle groups which are used in general bodily activities have not been involved in objective tests of rhythm.

2. The generally conceded superior rhythmic sense of the negro is based on observations and subjective judgments, with no evidence to prove the conclusions.

3. No study has been made of the learning ability of the white and colored race in relation to rhythm.

In view of the above points the following investigation was carried on in an attempt to compare the progress of the colored and white races in learning a rhythmic pattern. A new type of machine was constructed to meet the need of testing the fundamental muscles, at the same time retaining the objective methods used in the earlier rhythmic tests.

* Paper presented at the convention of the American Physical Education Association, Research Section, Louisville, Kentucky, April, 1933.

STATED specifically, the purpose of this study was to measure the learning of two groups of children (white and colored) as shown by graphically recorded response of the large-muscle groups of the leg, synchronized with a rhythm pattern set by an electrically driven tom-tom.

The subjects of this experiment were fifty white children and fifty colored children in the elementary grades (two through six). All of the colored children in each grade were used, but the white children were chosen at random; no attempt was made to classify the groups according to any standards of accomplishment other than the school grade. In the school systems from which the subjects were chosen, training in music was given throughout the elementary grades. The average time devoted to this subject was two and one-half hours per week. The white children receive some rhythm training in the physical education period; the colored children had no supervised rhythm training during school hours. This would indicate that the white children had a slight advantage in their educational background.

In order to ascertain the degree of musical training which the subjects might have had outside of the school curriculum, as well as to determine the nature of the musical experiences in everyday life, such as listening to musical renditions or participating in some form of dancing, a questionnaire was given to each child previous to the first trial.

The results of the questionnaire are shown in the following table:

	White	Colored
Number studying some musical instrument	23	3
Average time instrument studied	1⅓ year	1 year
Practice hours per week	14	7
Radio in home	28	0
Victrola in home	27	3
Piano in home	33	4
Dancing lessons	0	0

Extra-curricular and school training both favored the white group.

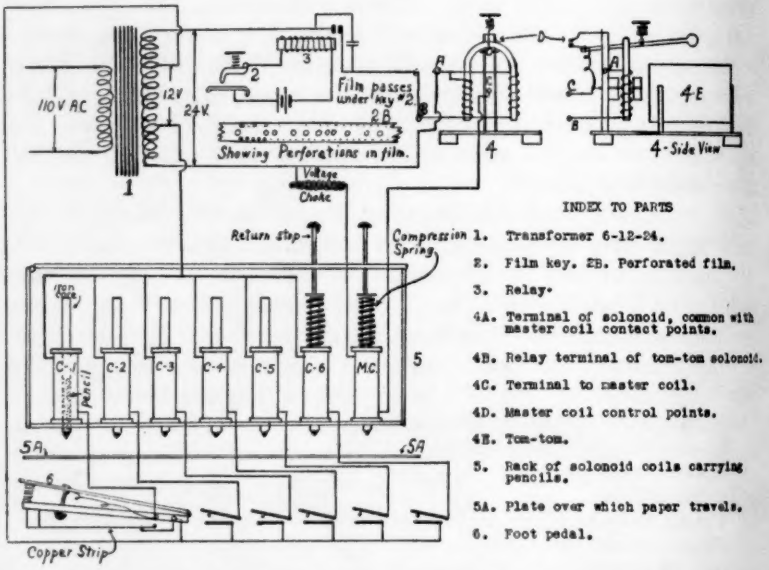
THERE were a number of points to be considered in relation to this experiment. The three most important were (1) the selection of a tempo typical of both negro and other music; (2) the use of the fundamental muscle groups to minimize any advantage in training of the accessory muscle groups; and (3) the use of an instrument which would eliminate the memorizations of a melody.

On a basis of the survey made of both negro and other music, a 4/4 tempo was chosen as a typical rhythm.

The leg muscles, which are classed as fundamental muscle groups, are subject to voluntary control. Fundamental muscle groups have been used since the earliest history of man, and the control of these muscles is learned earlier in the life of the child than that of the accessory

muscles, such as the fingers. Walking is considered by Dalcroze as the natural starting point in the child's initiation into rhythm. For these reasons the movement of stepping on a pedal was selected as the child's most natural reaction to the beat of the tom-tom.

The tom-tom was selected because of the place of percussion instruments in the rhythmic history of the race. The beat of the drum has a tendency to secure the reaction of the larger muscles more than a light sound, such as a click. The second advantage in the use of this instrument was the elimination of the memorization of a tune in learning the pattern.



The response of the subjects was recorded by means of foot pedals. Pedal (6) was connected electrically to a solonoid (5) through which was suspended a short iron rod supported on the coil by a spring. A pencil was fastened to the lower end of this rod (5, c-1), which marked a moving tape when the subject stepped on the pedal.

The machine was motor driven to eliminate possible error in the pattern. A brush motor was selected because it varied less under voltage changes and load. The motor was geared to the recording and operating shaft to prevent slipping. A sprocket, from a motion picture machine, was mounted on the main shaft. This sprocket carried an endless strip of film. The film was marked by a metronome, to carry the rhythm pattern used in this experiment. The perforations allowed a metallic finger to drop through onto a metal plate (2), completing an electric circuit in the electromagnetic winding of a relay (3).

An alternating current (24 volts) was sent by the relay to a double solonoid coil (4). This solonoid operated a horseshoe armature (4) which was attached to the hammer of a tom-tom. As the tom-tom hammer was operated, it, in turn, closed the circuit for the master pencil solonoid (5-mc), marking the paper tape. This gave a standard pattern, graphically recorded, parallel to the subject's pattern, and this permitted the checking of the reactions of the subject with the standard set by the film.

The master pencil circuit is on the tom-tom hammer arm in order to compensate on the recording tape for the physical lag between the relay closing and the beating of the tom-tom (4-D). Since the inertia of the tom-tom driving armature and the hammer was greater than that of the pencil armature, the pencil would record before the actual stroke of the tom-tom, if the relay operated both at the same time. The paper tape was pulled through under a frame holding six subject pencil solonoids and the master pencil solonoid (5A). This was accomplished by a rubber roller of very nearly the same diameter as the sprocket which drove the operating film. An idler held against the roller under spring tension provided the friction which pulled the paper through.

There may have been some slight lag of the paper behind the film but this lag introduced no error as the master pencil marked the pattern on the paper regardless of the speed. If the responses were identical with the pattern, they paralleled the standard mark on the paper.

The tom-tom was mounted about three-eighths of an inch above a movable wooden platform to allow the lower membrane to vibrate more freely.

THE machine was located in an adjoining room to prevent the noise of the motor or the click of the pencils from distracting the attention of the subjects. The six pedals were arranged in a semi-circle, as far apart as the wiring permitted. A chair was placed behind and to the side of each pedal, and the subject was urged to take hold of a chair on either side to aid in the balance of the body.

The tom-tom was placed behind the chairs in the center of the semi-circle. The subjects were blindfolded to eliminate the possibility of their reacting to the footwork of another subject.

Between each trial the blindfolds were removed and the subjects allowed to rest and change body positions. A longer interval of rest was necessary for the pupils of the lower grades, because of the greater strain involved in following a stimulus which was longer, perhaps, than the attention span at this age normally includes.

An explanation was given to each group of six subjects, stating that their responses to the beating of the tom-tom were to be recorded. Each time they stepped on the pedal a pencil mark was made by the machine

which they had seen on their way into the experiment room. The subjects were instructed to assume as comfortable a position as possible and still have one foot free with which to step on the pedal. Practice in stepping on the pedal was given; either foot was used, according to the natural inclination of the subject. This gave training in the muscle reactions the subjects were to make. Then the pattern was given twice, so as to accustom the children to the sound of the tom-tom. They were instructed to follow the rhythm as closely as possible, stepping in exact time with the sound of the tom-tom. Next, final instructions were given: "With your foot ready to step on the pedal, we are ready for the beat of the tom-tom." After the intervals of rest, the signal "Ready" was given to focus the attention of the subjects and to serve as a signal to start the machine. Four trials a day for six days were given to each individual. These trials were given on alternate days, in order to make the time between each series of practices as even as possible, allowing for the necessary interval between Friday and Monday.

The pattern used was selected after general experiments with summer school students and conferences with experts in music. In order to establish the difficulty of the pattern for this age child, a few white children from the second and fourth grades (not included in the experiments) were started.

The interest of both white and colored children was very good throughout the experiment. The difference in the total reaction to the rhythm pattern of white and colored children was marked. During the experiment the white children stood quite still, moving only the foot which was on the pedal. They made no motor response other than the required steps. The colored children, on the contrary, had a definite tendency to sway forward and backward to the rhythm of the pattern. At times the entire body swayed; at other times only the head moved. One child used the toe of his left foot to syncopate, while with his right foot he followed the beat of the tom-tom. Another child, acting the part of an imaginary drum major, used a small stick to keep time to the rhythm of the pattern.

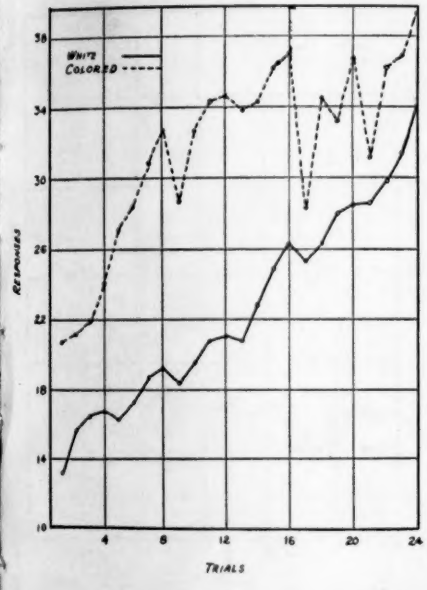
Groups were compared by computing the arithmetic mean of each trial for each grade group. These were then plotted to give a graphic representation of the learning curves of the white and colored children of each grade. All data for each race were combined to give a total learning curve for the white and a total learning curve for the colored children.

THE graphs show the twenty-four learning steps, comprising a series of four trials on each day for six days.

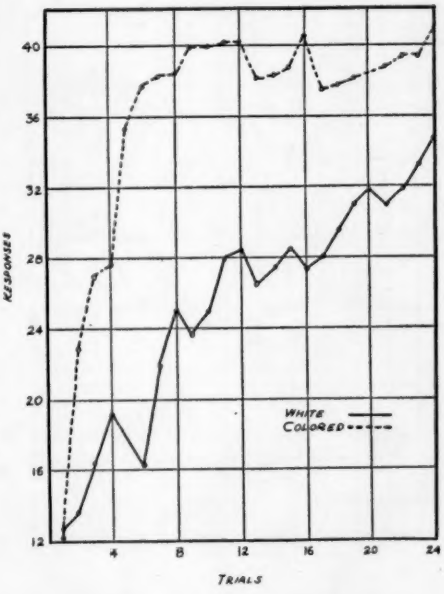
Graph I.—Graph I shows a decided improvement of both white and colored second grade children. The colored group averaged 20.7 correct

responses on the first trial, finishing with 39.5 correct responses. The white group averaged 10.7 on the first trial and 33.6 on the twenty-fourth trial. The learning curve of the colored group started higher and ended higher, although the white groups made some gain and tended to approach the colored group at the end of the experiment. The initial learning curve of the colored children seemed to be more rapid and consistent than that of the whites; however, this was offset somewhat by the irregularity of the curves after the first three days' series of trials. The white subjects showed a regular steady increase at a slower rate and a slight set-back from the end of one day's series to the beginning of the next. The irregularities in the curves of the fifth day's series may be due to the excessive heat of the day.

GRAPH I. Average number of correct responses per trial for grade 2.



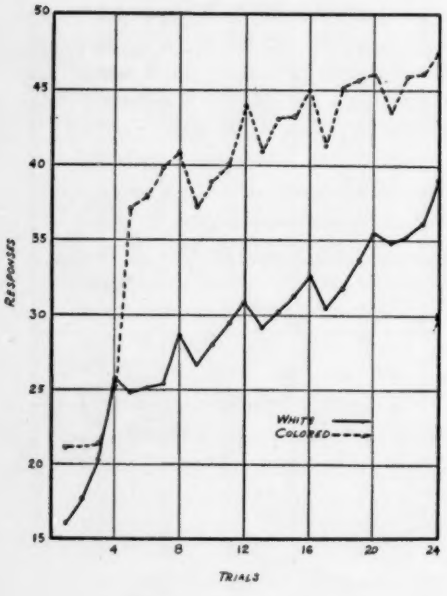
GRAPH II. Average number of correct responses per trial for grade 3.



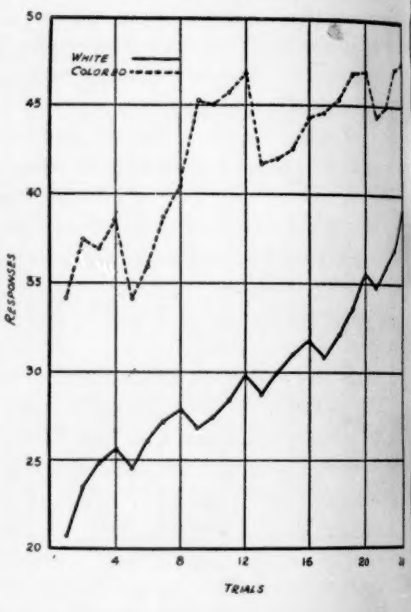
Graph II.—White and colored groups of grade three started below the point of grade two. Both groups, however, finished above the final record made by the second grade. The third grade illustrated most strikingly the rate of learning of the two groups. The colored group arrived at the point of greatest learning at the ninth trial; from then on the record fluctuated and finished only slightly higher. The white group, on the other hand, progressed steadily with a slight characteristic set-back after each day's series.

Graph III.—The fourth grade group started and finished well above the record of either of the lower grades. The colored groups showed a superiority from the start through to the finish. In the first day's series, however, the white group caught up with the colored group, only to be strikingly outdistanced by them the second day. The curves of the two groups from the third to the sixth day's series were more similar. There

GRAPH III. Average number of correct responses per trial for grade 4.



GRAPH IV. Average number of correct responses per trial for grade 5.



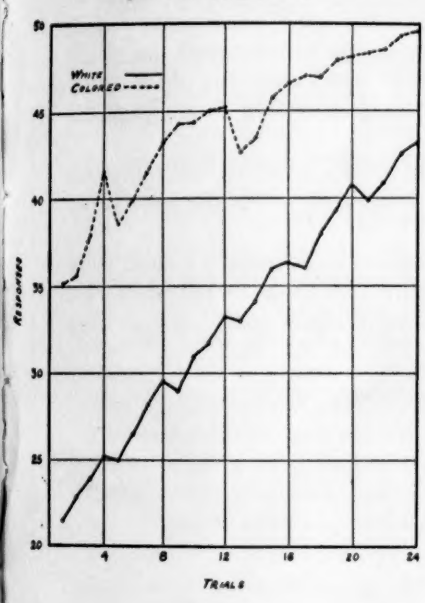
were slightly greater fluctuations in the colored group with a more steady rise in the white group.

Graph IV.—Both groups in the fifth grade started above the fourth grade, but finished at about the same point. The colored groups started well above the white group and finished above them, although the white group was beginning to catch up. The colored group had a more irregular curve with a marked drop between the first and second, third and fourth, fifth and sixth day's series. On the other two days an increase was apparent. The white children, on the other hand, showed a slight drop after each interval. The initial rate of learning of the colored group is greater than the white, although this is not as pronounced as in the lower grades.

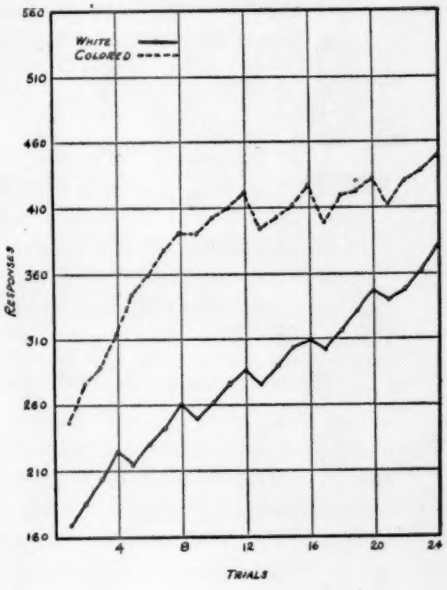
Graph V.—Both groups in grade six started and finished somewhat above grade five. The colored group was distinctly superior at the start

and somewhat less so at the finish. These two groups showed more clearly the fact that the white groups tended to gain on the colored. The curve for the white children had a regular and steady increase in each day's series with but a slight drop at the intervals. The learning curve of the colored groups was less regular. A pronounced drop was evident

GRAPH V. Average number of correct responses per trial for grade 6.



GRAPH VI. Average number of correct responses per trial for all groups.



between the first and second and again between the third and fourth day's series. No less was evident on the other days.

Graph VI.—The curves showing the average of the children of all grades of each group bring out the outstanding differences: namely, the superiority of the colored group in rhythmic ability as measured by this test; the greater rate of initial learning of the colored children. The total learning curve of the white race shows a remarkably steady progress with a slight loss from the end of one day's series to the beginning of the next.

The points that are evident in all the graphs show the superior rhythmic sense of the negro, which is rather an expected result; the rapid initial learning of the colored race, which is probably a reflection of the greater interest in rhythmic activities; and the higher variability of the negro children caused, perhaps, by a tendency to emotional instability.

THE results of this experiment would indicate:

1. Under the conditions of this experiment there is an appreciable degree of learning a motor response to a rhythm pattern, as represented by the number of correct responses made by all the children over a period of twenty-four trials on six different days.

2. Motor rhythm, as measured by this test, is a function of school age, each grade being superior to the preceding grade.

3. Colored children of each grade are superior to white children in motor rhythm, both at the beginning and the end of the learning period.

4. The initial rate of learning (from the first through the eighth trial) of the colored group is much more rapid than that of the white. At the end of the eighth trial the white groups tend to approach the score of the colored.

5. At the end of the second or third day's series the colored group has approached a plateau in learning motor rhythm, but the white group still progresses at a fairly even rate.

6. The learning of the colored groups in each grade is a much more variable process than that of the white. The curve of the white race shows a steady gain through the experiment with a small loss after each day's series.*

*The above study was completed in the State University of Iowa.

A Survey of Methods of Grading Women in Individual Gymnastics in Colleges and Universities

By Elizabeth Noyes
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THIS survey* owes its origin to the fact that one teacher of individual gymnastics has been unable, during several years' experience, to devise or discover any accurate method of determining the grades of her students. Because of the nature of these classes, no objective tests could be found which were usable with all or even a majority of the students. The factors which could be tested objectively seemed relatively unimportant when compared with other factors for which no test was available but the instructor's personal opinion. It was impossible to omit these untestable factors; it seemed equally impossible to grade them with any degree of accuracy. In the meantime, it was observed with some envy that in the swimming, gymnastics, sports, and other physical education classes, comparatively satisfactory tests had been evolved, and were in use. It seemed desirable from an administrative point of view that all classes should be graded on at least a similar basis, but there was no grading scheme which would include individual gymnastics with the other forms of physical education. As a first step toward the possible solution of these problems, this survey proposed to make a detailed study of grading methods now in use in individual gymnastics classes for women in colleges and universities in the United States.

STATEMENT OF THE PROBLEM

The problem which is undertaken in this paper, then, is to discover what methods of grading are now in use in the various institutions covered by the survey, to analyze the steps by which the grading is done, and finally to determine the general trends in grading which may appear in the course of the study.

The field of this investigation is limited to individual gymnastics classes for women in colleges and universities in the United States.

DESCRIPTION OF PROCEDURE

An analysis of the problem was made, and a questionnaire was formed and sent to the directors of physical education for women in 222 colleges

* Abstract of a thesis presented at New York University, 1932.

and universities throughout the country. This list included all institutions listed in the *College Blue Book*[1] as members of the American Association of University Women (except for a few which were known to have no department of physical education for women) and also several institutions not so listed but known to offer work in individual gymnastics.

A QUESTIONNAIRE ON METHODS OF GRADING WOMEN IN INDIVIDUAL GYMNASTICS IN COLLEGES AND UNIVERSITIES

I. a) Is academic credit given for physical education at your institution? Yes ( ) No ( ).
b) Is a grade given in Physical Education? Yes ( ) No ( ).
c) Is a grade given in Individual Gymnastics? Yes ( ) No ( ).

II. Underline types of cases registered in Individual Gymnastics: defective feet, posture, menstruation, elimination, heart or glandular function; paralysis, other orthopedic conditions; convalescent, chronic or post-operative conditions; fatigue, nervousness; any others:—

III. What is the general method of grading in Individual Gymnastics? (Underline one)—teacher's opinion, objective rating, any combination of these.

IV. In column I, below, check all factors which you consider in grading Individual Gymnastics.
In column 2, give approximate per cent of grade at which you value each factor.
In column 3, give method of grading each factor.
In column 4, give objective standard used in judging factor, if any.
(Study examples carefully before answering questions.)

1. Factors	2. Per Cent.	3. Method of Testing	4. Objective Standard
Examples			
Costume	5	daily inspection	department req.
Posture improvement	15	silhouetteograph	Fradd chart
Interest	25	daily observation	none
Knowledge of health habits	10	written examination	textbook

Routine Factors:
Attendance Punctuality Costume Cleanliness Shower Any others

Achievement Factors: Improvement in—
Specific defect—Posture Weight Skills Any others

Personal Factors:
Interest Cooperation Perseverance Any others

Knowledge of:
Own physical condition Posture Relation of health habits
Health habits (general) Any other factors to own condition

V. Are students failed on any other basis than the total of the percentages listed above? If so, what?

VI. Does this grading system apply equally well to all students? To what types of cases does it not apply?

VII. Any comments or explanations:—

Name: Title:
Institution: Date:

[1] H. W. Hurt, *The College Blue Book*, vol. 1, Hollywood by the Sea, Florida: College Blue Book Company, 1928.

GENERAL SUMMARY OF REPLIES

Analysis of the replies to the questionnaire brought out a good deal of specific information, including the following facts:

1. Sixty-three per cent of the institutions answering the questionnaire conduct classes in individual gymnastics.

2. Eighty-four per cent of the institutions answering question I give academic credit for physical education, and 98 per cent of them give a grade in this subject. Eighty per cent of the institutions give a grade in individual gymnastics.

3. In the 66 replies to question II it was reported that the types of cases registered in individual gymnastics classes included feet in 59 cases or 89.3 per cent; posture 87.8 per cent; menstruation 84.8 per cent; heart 72.8 per cent; post-operative 69.8 per cent; elimination 66.7 per cent; convalescent 63.6 per cent; glandular and nervousness each 62.1 per cent; fatigue 60.0 per cent; paralyses 57.5 per cent; other orthopedic 54.5 per cent; chronic 48.5 per cent; weight 25.7 per cent; and miscellaneous 16.6 per cent.

4. Grading is done by a combination of objective and subjective rating in 60.3 per cent of the institutions answering this question, and by purely subjective rating in 34.4 per cent.

5. The factors used by 66 institutions in grading percentage value given each, methods of testing, and objective standards used as shown in Tables A and B.

6. Grades are given entirely on the basis of percentages listed in 35 out of 54 institutions, and overcutting alone will cause failure in spite of a satisfactory percentage in 19, or 35 per cent.

7. Of the 44 instructors answering question VI, 27 considered that their grading systems applied equally well to all students. Rest cases and cases of permanent handicap were listed as being the most difficult to grade.

CONCLUSIONS

From the facts which have just been listed, certain general conclusions may be drawn.

1. Classes in individual gymnastics are conducted in the majority of institutions.

2. Academic credit is given and a grade awarded in this subject as well as in physical education in general, in a large majority of cases.

3. Classes in individual gymnastics represent a wide variety of types of cases.

4. In grading, achievement factors, and especially improvement in posture and conditions, are considered the most important. Routine factors are second in emphasis, and personal and knowledge factors are given comparatively small place. Testing is done by written, practical

and physical examinations, observation, inspection, and routine records. Objective standards are found in department requirements, charts, books of reference on hygiene, and medical standards.

5. The problem of grading is felt to be a difficult and cc 'ex one.

TABLE A

SUMMARY OF FACTORS USED IN GRADING

Factor	Times checked	Average per cent	Method of testing	Objective standards used
Routine Factors				
Attendance	53	13.97	Roll call	Dept. requirement
Punctuality	48	6.62	" "	" "
Costume	37	5.97	Inspection	" "
Cleanliness	28	6.45	Observation of inspection	" "
Shower	18	5.45	Daily record	" "
Achievement				
Improvement in specific defect	55	18.36	Examination and Conference	None
Posture	58	18.99	Picture and Examination	Posture charts
Weight	28	10.03	Weighing	Standard charts
Skill	38	15.22	Observation and specific tests.	Standard for each test
Personal				
Interest	51	11.87	Observation	None
Cooperation	43	9.6	"	"
Perseverance	42	9.46	"	"
Knowledge of own condition	10	8.41	Written exam.	"
General Hygiene	26	8.17	" "	"
Habits relative to condition	31	7.78	Conference or Examination	Health Knowledge
Posture habits	36	9.35	Examination	

TABLE B

TYPES OF FACTORS USED IN GRADING

Type of Factor	Total times checked	Total per cent	Score—per cent times No. of times checked	Per cent of total score
Routine	184	38.5	7074	27.2
Achievement	179	62.6	11205.4	43.1
Personal	136	30.9	4202.4	16.2
Knowledge	103	33.7	3471.1	13.5

DISCUSSION

The chief result of this summary is the demonstration of a complete lack of standardization in grading students in individual gymnastics classes. No two departments use the same system, and many do not have the same system for all students. The fact that a large number of departments have not even analyzed the grading system on a percentage basis, and the scarcity of objective standards for measurement should stimulate research workers to further efforts in this practically virgin field. As long as grades are given in physical education they should be determined in the most impartial and reliable manner possible. Perhaps the present, chiefly subjective method is reliable, but it is always open to question by disgruntled recipients of low grades. For self-protection then, as well as in the interest of accuracy and justice, this admittedly difficult problem of grading should be seriously studied by all teachers of individual gymnastics.

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The Relation of Abdominal Strength to Dysmenorrhea*

By Helen D. Denniston, M.D.
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MANY physicians who have made a study of the causes of dysmenorrhea have come to the conclusion that the majority of cases are accompanied by, and probably caused by, weak abdominal muscles, poor posture, and the poor circulation incidental to these. Some of these physicians are Dr. Clelia D. Mosher, Dr. Norman Miller, Dr. Margaret Sturgis, Dr. Florence Meredith, and Dr. Alice E. Clow.

Exercise as a corrective measure has been used by Dr. Meredith with methods reported in the *Journal of Gynecology and Obstetrics,* Chicago, 1920, and by many physical education teachers of girls, but just why they were useful or how valuable they are is another question.

During many years of physical examinations at the University of Wisconsin it was noted that the students having dysmenorrhea looked as if the abdominal muscles were weak; they certainly had poor posture. It was decided to study the relation of these conditions, so in the fall of 1931 Miss Marjorie Hamer, a graduate student at the University, began to gather material; but definite results could not be obtained until a sound, reliable method for testing abdominal strength could be found. This study of Miss Hamer's is published in the March, 1933, number of the Research Quarterly.

With the help of the Department of Physics of the University, a method of testing the abdominal strength was developed which eliminates the iliopsoas muscle and the weight of the body as a force for or against the muscles tested. The body of the subject is tilted backward from the ankles so that the tendency to fall forward is removed and the body supported so that the abdominal muscles are relaxed. Straps around the legs and pelvis are used to prevent movement of the hip flexors and the subject is told to keep her head in line with her body. The scales upon which the pressure is recorded allow such a small range of movement that the body cannot leave the supporting back rest far enough to bring the body weight into the problem. This also eliminates the "arc of movement" with the necessary change in the direction of pressure or force. The padded rod between the chest of the subject and the scales is adjustable to the varying chest depths. In contracting the

*A paper presented at the Research Section Meeting, Annual Convention of the American Physical Education Association, April, 1933.

abdominal muscles the chest is drawn forward and the pressure is registered in pounds and noted by the observer.

By this method and with this apparatus two groups of girls were tested; one group had normal menstrual periods and the other had dysmenorrhea. In every case the normal girls were stronger abdominally, the range of advantage being from 7 to 22 pounds.

Having thus proved that weak abdominal muscles accompany dysmenorrhea, it was decided to see if improvement in abdominal strength would be accompanied by improvement in the menstrual condition. Therefore, in the fall of 1932 a second study was begun by another graduate student, Miss Kathleen Brophy, using two groups of girls, all with dysmenorrhea, referred by the Student Health Clinic. All were tested and abdominal strength recorded. One group was given exercises to improve posture, strengthen abdominal muscles, influence pelvic and general circulation, and to recognize the feeling of tension and relaxation in large groups of muscles so as to finally be able to keep the abdominal muscles taut. One girl, unable to come into the classes in individual physical education used swimming to improve abdominal strength.

The other group was not given exercise but as the campus is extensive and hilly, it was expected that they would show considerable gain as a result of general student activity. At the end of a time that varied from thirteen to twenty-two weeks, the members of the experimental group were tested and the control group was tested after twenty to twenty-two weeks.

The results are as follows:

Of the control group, none improved in menstrual condition, but 63 per cent of the experimental group had much less pain and some no pain.

Of the control group, 56 per cent gained an average of 3½ pounds. Twenty-five per cent made no gain and 18 per cent lost an average of 3 pounds. The average gain was 1.23 pounds.

One hundred per cent of the experimental group gained, with a range of from 10 to 52 pounds or an average of 23.7. Of these, the 63 per cent who had less pain gained an average of 28½ pounds and 37 per cent reporting no improvement gained an average of 15½ pounds.

As the improvement in the menstrual condition can only be noted once in three to four weeks and as the duration of the experiment was very short, we expect that more of the experimental group would report improvement were the study carried on longer. All of the experimental group improved in posture and in general condition but as no record was made of control group posture, we can make no comparison.

Because we were able to observe the changes in the one student who took swimming, we can make our conclusions broader than otherwise and say that not only our prescribed exercises, but any exercises which increase abdominal strength seem to relieve dysmenorrhea.

The Nature, Frequency, and Age Incidence of Injuries in Interscholastic Football

By N. P. Neilson
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ATHLETIC competition between high schools in California is controlled by an organization known as the California Interscholastic Federation. Two representatives from each of four sections of the state, with the State Director of Health and Physical Education, form a group of nine persons known as the state council. At a meeting of the state council of the California Interscholastic Federation, held in Berkeley, November 19, 1932, the advisability of lowering the age limit for eligibility of high school boys to play interschool American football was discussed.[1] No definite conclusions were reached. In order to better understand this problem the State Director of Health and Physical Education was requested to secure the facts regarding the nature and frequency of injuries to players, by age groups, which occurred during the past football season.

Under date of January 3, 1933, a letter and blank were sent to every high school principal (386) in California. The letter contained a statement which indicated why the study was being made and also gave the following information:

"Enclosed is a blank which we would like filled out by your physical education instructor. Please list all players who became members of the football squad during the past season. Record the date of birth opposite each name so we can compute the age of all players in the state as of a given date. If the player received no injuries of any kind check in the column labelled 'Not injured.' For all players who were injured consult the code for type of injury and record the number in the column marked 'No.' The instructor should check opposite each number of the injury whether in his own judgment the injury was 'Class A' or 'Class B.' Ordinarily, an injury forcing the player to be an inactive member of the squad for several days would be considered a 'Class B' injury.

"If the school had more than one team which played interschool American football games, construct additional sheets for the other teams and follow the same procedure in checking.

"Your attention to this request will assist the State Department of Education and the California Interscholastic Federation in their desire to reduce the number of injuries which occur in interschool football contests."

The following form is a sample of the blank enclosed with the letter:

[1] The present age limit is twenty-one years. The problem considered was whether lowering the age limit to nineteen years would reduce the number of injuries to football players.

A STUDY OF INJURIES IN AMERICAN FOOTBALL (INTERSCHOLASTIC)

Name of School..... City.....

Name of Football Coach.....

No.	Name of Player	Date of Birth			Not Injured	Injured		
		Mo.	Day	Year		Code No.	Class A	Class B
Example:	J. Hanson	3	18	15		18		V
1								
2								
23								
24								

Injury Code Number

1. Bruise
2. Concussion

Cuts
3. Arm
4. Body
5. Head
6. Leg

Dislocations
7. Ankle
8. Elbow
9. Hip
10. Knee
11. Sacro-iliac (Displacement)
12. Shoulder
13. Spine

Fractures
14. Arm
15. Clavicle
16. Foot
17. Hand
18. Jaw
19. Leg
20. Nose
21. Rib
22. Skull
23. Spine

24. Infections

Sprains
25. Ankle
26. Back
27. Elbow
28. Finger
29. Knee
30. Shoulder
31. Spine
32. Toe
33. Wrist

34. Teeth
35. Water on Knee
36. Others (Name)

There are in California four-year high schools (grades 9-12), branch high schools (grades 9-11), six-year elementary and high schools (grades 1-12), senior high schools (grades 10, 11, and 12), junior-senior high schools (grades 7-12), high schools with junior college courses, and high schools with district junior colleges. With very few exceptions, members of high school football teams in California come from grades 9, 10, 11, and 12 in these types of schools. A report of enrollment made by all principals to the State Department of Education on October 17, 1932, shows a total regular enrollment in these types of high schools in grades 9, 10, 11, and 12, of 220,261 pupils.

After two follow-up letters had been sent, fourteen schools having a total enrollment in grades 9, 10, 11, and 12, of 9,597 pupils, failed to return the information requested. There was, therefore, a total enrollment

on October 17, 1932, of 220,261 less 9,597, or 210,664 pupils in the schools which furnished the data for the study. Assuming 50 per cent of the pupils were boys, there were enrolled 105,332 boys from which

TABLE 1

CALIFORNIA HIGH SCHOOL ENROLLMENTS AS OF OCTOBER 17, 1932, GIVEN BY GRADES AND TYPES OF SCHOOLS[2]

Type of School	No. Schools	Grade 9	10	11	12	Total
Four-Year H. S. Grades 9-12	264	31,029	35,300	29,201	23,937	119,467
Branch H. S. Grades 9-11	10	219	92	6		317
Six-Year Elem. and H. S. Grades 1-12 ...	6	352	371	312	282	1,317
Senior H. S. Grades 10, 11, 12 .	34		20,806	17,394	14,018	52,218
Jr.-Sr. H. S. Grades 7-12	48	7,696	7,964	6,404	4,681	26,745
H. S. with Jr. College Course	18	3,236	3,738	3,408	2,964	13,346
H. S. with Dist. Junior College	6	958	1,386	2,357	2,150	6,851
Totals	386	43,490	69,657	59,082	48,032	220,261

the football players in the schools which returned the blanks were selected.[3]

Tabulation of data was begun March 20, 1933. Large sheets were arranged upon which were written the names of all schools, age intervals for boys not injured, and age intervals for boys receiving "Class A" and "Class B" injuries. Tabulation by schools and by age levels of all cases reported not injured was comparatively easy.[4] In tabulating by schools and by age levels all cases reported injured, the number of the injury, and whether it was "Class A" or "Class B" had to be included.[5]

For the sake of brevity a number of tables have been arranged. These appear in order and without detailed explanations. The essential information appears in the summary and conclusions.

[2] Data secured from the Division of Research and Statistics, California State Department of Education.

[3] While this method of finding the number of boys enrolled may be questioned, it was the best course open to us in this study. It is without question a better method than to have asked principals in January what their boy enrollments were in October.

[4] The blanks required the date of birth of each player to be written opposite his name. From a table constructed for the purpose, ages for all boys were computed to the nearest month as of October 15, 1932.

[5] Appreciation is extended to Miss Winifred Van Hagen, Division of Health and Physical Education, California State Department of Education, for the many hours of careful work spent in tabulating the data.

TABLE 2

CALIFORNIA HIGH SCHOOLS WHICH DO NOT PLAY FOOTBALL
(ARRANGED IN ORDER OF ENROLLMENT)

No.	Name of High School	Enrollment by Years				Total Enrollment
		9	10	11	12	
1	San Bernardino Detention Home		1	2	1	4
2	West Point	8				8
3	Sierra Valley Joint Union-Loyalton	5	3	2		10
4	Sierra City (Sierra)	5	3	2		10
5	Camptonville (Yuba)	4	7			11
6	Downieville (Sierra County)	4	3	4		11
7	Stirling City	8	5			13
8	Sierraville (Sierra)	6	1	5	3	15
9	Tahoe (Placer)	2	5	7	2	16
10	Leggett Valley		4	10	2	16
11	Forest (Sierra)	14	3			17
12	Big Pine Union	4	10	2	2	18
13	Paradise	21				21
14	Alpaugh (Tulare)	10	5	5	2	22
15	Owens Valley Union (Inyo)	10	6	5	1	12
16	New Pine Creek (Oregon)	4	6	5	7	22
17	El Retiro Senior		17	3	2	22
18	Happy Camp (Siskiyou)	14	16			30
19	Randsburg (Kern County)	25	5			30
20	Bieber (Part of Lassen Union)	7	7	5	14	33
21	Boulder Creek Union Senior	13	15	6		34
22	Fort Bidwell	7	10	4	14	35
23	Eastside (Imperial County)	21	7	6	1	35
24	Shandon (Paso Robles)	10	8	13	4	35
25	Big Bear (Pine Knot) Victor Valley	7	16	10	3	36
26	Elk Creek	7	14	8	8	37
27	Potter Valley (Ukiah)	6	17	8	7	38
28	Middletown Union	14	8	10	9	41
29	Hopland Union	13	11	9	8	41
30	Meadow Lake Union (Truckee)	16	10	13	8	47
31	Pescadero Union	8	21	6	14	49
32	Geyserville Union	19	8	17	7	51
33	Sierra Union	23	9	15	5	52
34	Avalon Senior—Long Beach		21	19	12	52
35	Fort Jones (Siskiyou)	14	13	12	16	55
36	Greenville Senior (Plumas)	21	19	10	11	61
37	Big Valley Joint Union (Adin)	16	16	17	13	62
38	Point Arena	11	26	18	10	65
39	Portola Senior		25	23	17	65
40	Julian Union	28	15	8	15	66
41	Anderson Valley Union (Mendocino)	22	21	11	12	66
42	Wheatland Union	19	24	13	12	68
43	Denair Union	25	20	13	13	71
44	Mountain Empire Union	28	19	13	11	71
45	Laton Joint Union	29	18	13	13	73

TABLE 2 (*Continued*)

No.	Name of High School	Enrollment by Years				Total Enrollment
		9	10	11	12	
46	Upland (San Bernardino)	74				74
47	Round Valley Union	26	15	18	17	76
48	Plumas County (Quincy)	22	23	16	15	76
49	Butte Valley (Dorris)	23	26	11	17	77
50	Kelseyville Union	28	17	17	15	77
51	Cloverdale Union	24	13	14	27	78
52	Surprise Valley Union (Cedarville)	29	24	22	10	85
53	Princeton Joint Union	23	22	25	15	85
54	Etna Union	26	17	24	19	86
55	Simi Valley Union (Simi)	24	22	24	16	86
56	Benicia	26	31	13	18	88
57	Chino Vocational (San Bernardino)	37	25	17	12	91
58	Mount Shasta	22	25	21	24	92
59	Maxwell Union	22	28	25	19	94
60	Trinity County (Weaverville)	31	22	18	27	98
61	South Fork Union (Miranda)	30	26	28	15	99
62	Ramona Union	33	25	20	21	99
63	Willits Union		35	42	23	100
64	Linden Union (San Joaquin)	29	33	24	14	100
65	Fall River Jt. Union (McArthur)	30	31	23	18	102
66	Calipatria Union	45	27	22	10	104
67	Hamilton Union	33	39	22	13	107
68	East Nicolaus	31	27	28	22	108
69	Santa Ynez Valley Union	36	28	26	19	109
70	Palo Verde Union (Blythe)	35	31	23	20	109
71	Calistoga Joint Union	29	33	23	24	109
72	Tranquility Union	30	30	27	23	110
73	Live Oak Union	35	37	25	14	111
74	Gustine Union	31	30	32	22	115
75	Fallbrook Union	50	27	25	20	122
76	Tomales Jt. Union	31	38	24	31	124
77	Mariposa County (Mariposa)	48	36	27	23	134
78	Orestimba Union (Newman)	43	29	35	32	139
79	Folsom Union	36	43	35	26	140
80	Calaveras Union (San Andreas)	49	37	29	34	149
81	Sonoma Valley Union	54	45	44	34	177
82	Liberty Union (Brentwood)	52	57	45	25	179
83	Anderson Valley (Boonville)	65	46	42	34	187
84	Imperial Valley Union (Imperial)	53	58	48	33	192
85	Live Oak Union (Morgan Hill)	81	51	38	34	204
86	Lincoln Senior	55	41	64	44	204
87	Wasco Union	76	64	44	39	223
88	Coalinga Union	100	83	68	62	313
89	Campbell Union	120	113	69	69	371
90	Fortuna Union	131	98	130	90	449
91	Girls H. S., San Francisco		297	282	220	799
	Totals	2436	2403	2031	1638	8508

TABLE 3

PERCENTAGE OF BOYS INJURED OF THOSE PLAYING

Age Groups	Number of Boys Not Injured	Number of Boys Injured	Total Number of Boys Who Played	Percentage Injured of Boys Playing at Each Age Level
No Age Given .	8	2	10	20.00
12-0—12-5	1	0	1	00.00
12-6—12-11 ...	7	0	7	00.00
13-0—13-5	21	1	22	4.54
13-6—13-11 ...	117	18	135	13.33
14-0—14-5	351	37	388	9.54
14-6—14-11 ...	565	72	637	11.30
15-0—15-5	872	140	1,012	13.83
15-6—15-11 ...	1,153	223	1,376	16.21
16-0—16-5	1,470	347	1,817	19.09
16-6—16-11 ...	1,474	365	1,839	19.84
17-0—17-5	1,445	509	1,954	26.05
17-6—17-11 ...	1,183	461	1,644	28.04
18-0—18-5	857	361	1,218	29.64
18-6—18-11 ...	502	189	691	27.35
19-0—19-5	289	135	424	31.84
19-6—19-11 ...	153	82	235	34.89
20-0—20-5	50	38	88	43.18
20-6—20-11 ...	29	20	49	40.82
21-0—21-5	7	2	9	22.22
21-6—21-11 ...	0	1	1	100.00
22-0—Over ...	2	0	2	00.00
Totals	10,556	3,003	13,559	22.15

TABLE 4

NUMBER OF INJURIES BY AGE LEVELS

Age Levels	Number of Class "A" Injuries	Number of Class "B" Injuries	Total Number of Injuries	Percent of Class "B" Injuries of Total Number of Injuries
No age given	1	1	2	50.00
12-0 to 12-5	0	0	0	00.00
12-6 to 12-11	0	0	0	00.00
13-0 to 13-5	1	0	1	00.00
13-6 to 13-11	12	6	18	33.33
14-0 to 14-5	24	14	38	36.84
14-6 to 14-11	61	12	73	16.44
15-0 to 15-5	107	37	144	25.70
15-6 to 15-11	155	80	235	34.04
16-0 to 16-5	252	119	371	32.07
16-6 to 16-11	258	123	381	32.25
17-0 to 17-5	387	153	540	28.33
17-6 to 17-11	332	161	493	32.65
18-0 to 18-5	242	142	384	37.00
18-6 to 18-11	128	72	200	36.00
19-0 to 19-5	91	49	140	35.00
19-6 to 19-11	57	30	87	34.48
20-0 to 20-5	30	10	40	25.00
20-6 to 20-11	17	4	21	19.05
21-0 to 21-5	2	0	2	00.00
21-6 to 21-11	0	1	1	100.00
22-0 & Over	0	0	0	00.00
Totals	2157	1014	3171	31.97

TABLE 5
FREQUENCY OF TYPES OF INJURIES

Rank	Class "A" Injuries	No.	Rank	Class "B" Injuries	No.	Rank	Total Number of Injuries	No.
1	Bruise	570	1	Bruise	117	1	Bruise	687
2	Sprained Ankle	377	2	Sprained Ankle	112	2	Sprained Ankle	489
3	Sprained Knee	191	3	Sprained Knee	87	3	Sprained Knee	278
4	Sprained Shoulder	133	4	Fractured Clavicle	56	4	Sprained Shoulder	168
5	Cut Head	111	5	Fractured Arm	45	5	Cut Head	126
6	Sprained Finger	96	6	Fractured Leg	42	6	Sprained Back	123
7	Sprained Back	82	7	Dislocated Knee	41	7	Sprained Finger	103
8	Infection	65	8	Sprained Back	41	8	Infection	91
9	Sprained Wrist	54	9	Dislocated Shoulder	39	9	Dislocated Knee	76
10	Cut Leg	50	10	Fractured Hand	37	10	Sprained Wrist	72
11	Concussion	43	11	Fractured Nose	37	11	Fractured Nose	67
12	Dislocated Knee	35	12	Sprained Shoulder	35	12	Dislocated Shoulder	62
13	Teeth	31	13	Water on Knee	35	13	Fractured Clavicle	59
14	Fractured Nose	30	14	Fractured Foot	34	14	Concussion	58
15	Sprained Elbow	25	15	Fractured Rib	33	15	Cut Leg	56
16	Dislocated Shoulder	23	16	Infection	26	16	Fractured Rib	55
17	Dislocated Ankle	23	17	Sprained Elbow	19	17	Fractured Hand	55
18	Fractured Rib	22	18	Sprained Wrist	18	18	Fractured Leg	52
19	Cut Arm	21	19	Concussion	15	19	Water on Knee	51
20	Fractured Hand	18	20	Cut Head	15	20	Fractured Arm	48
21	Water on Knee	16	21	Teeth	13	21	Teeth	44
22	Sprained Toe	14	22	Dislocated Elbow	9	22	Sprained Elbow	44
23	Dislocated Spine	10	23	Dislocated Spine	8	23	Fractured Foot	40
24	Fractured Leg	10	24	Sprained Spine	8	24	Dislocated Ankle	30
25	Sprained Spine	10	25	Dislocated Ankle	7	25	Cut Arm	23
26	Cut Body	9	26	Sprained Finger	7	26	Dislocated Spine	18
27	Dislocated Elbow	8	27	Dislocated Hip	6	27	Sprained Spine	18
28	Fractured Foot	6	28	Fractured Spine	6	28	Dislocated Elbow	17
29	Dislocated Hip	5	29	Cut Leg	6	29	Sprained Toe	17
30	Sacro-iliac Displacement	3	30	Sacro-iliac Displacement	5	30	Dislocated Hip	11
31	Fractured Arm	3	31	Fractured Jaw	4	31	Cut Body	11
32	Fractured Clavicle	3	32	Sprained Toe	3	32	Fractured Spine	8
33	Fractured Spine	2	33	Cut Arm	2	33	Sacro-iliac Displacement	8
34	Fractured Jaw	1	34	Cut Body	2	34	Fractured Jaw	5
35	Fractured Skull	0	35	Fractured Skull	0	35	Fractured Skull	0
	Others	57		Others	44		Others	101
	Total	2157		Total	1014		Total	3171

TABLE 6

NUMBER OF INJURIES BY TYPES AND AGE LEVELS

No.	Name of Injury	*Age Levels*									
		No Age Given	12-0 12-5	12-6 12-11	13-0 13-5	13-6 13-11	14-0 14-5	14-6 14-11	15-0 15-5	15-6 15-11	16-0 16-5
1	Bruise					5	6	18	36	51	87
2	Concussion					1			3	2	2
3	Cut Arm							1	3	5	4
4	Cut Body						1		1		
5	Cut Head					2	2	1	3	8	14
6	Cut Leg						1		2	4	3
7	Dislocated Ankle						3		1	1	3
8	Dislocated Elbow										2
9	Dislocated Hip							1			2
10	Dislocated Knee							1	2	7	10
11	Sacro-iliac Displacement								1		1
12	Dislocated Shoulder					1	1	1	2	2	4
13	Dislocated Spine							1	1	1	5
14	Fractured Arm						1	2	3	9	8
15	Fractured Clavicle	1					1	2	2	7	7
16	Fractured Foot						1		4	3	2
17	Fractured Hand					1	2	1	3	4	6
18	Fractured Jaw										2
19	Fractured Leg						4	2	4	7	4
20	Fractured Nose							2		2	9
21	Fractured Rib						1	2	2	7	5
22	Fractured Skull										
23	Fractured Spine									1	
24	Infections							2	3	6	19
25	Sprained Ankle					1	8	11	20	30	55
26	Sprained Back	1				2		3	5	11	15
27	Sprained Elbow										
28	Sprained Finger							5	9	12	13
29	Sprained Knee				1	2	2	8	11	15	39
30	Sprained Shoulder					1	2	1	10	6	19
31	Sprained Spine							1		2	2
32	Sprained Toe							1	1	1	3
33	Sprained Wrist					1		1	4	10	13
34	Teeth					1		4	1	6	4
35	Water on Knee								2	4	8
36	Other Types						2	1	5	11	12
	Totals	2	0	0	1	18	38	73	144	235	371

TABLE 6 (*Continued*)
NUMBER OF INJURIES BY TYPES AND AGE LEVELS

	Age Levels												
	16-6 16-11	17-0 17-5	17-6 17-11	18-0 18-5	18-6 18-11	19-0 19-5	19-6 19-11	20-0 20-5	20-6 20-11	21-0 21-5	21-11 21-6	22-0 Over	Totals
1	81	124	107	86	30	30	12	9	3	1	1		687
2	11	12	7	8	3	6	1	2					58
3		5		3	1	1							23
4	1	3	2	2	1								11
5	23	22	15	17	10	5	3	1					126
6	5	18	10	3	4	2	4						56
7	3	7	5	3	2		2						30
8	5	4	3	1	1		1						17
9	1	1		2	3		1						11
10	7	14	14	11	3	4	3						76
11		1	1	1	3								8
12	5	11	14	12	4	2		3					62
13	2	3	1	2	1			1					18
14	4	3	8	5	3	1	1						48
15	11	10	7	7	1	1		2					59
16	4	5	12	4	2	2		1					40
17	7	11	6	7	5	1	1						55
18		1			1	1							5
19	5	7	5	6	3	1	3		1				52
20	10	16	11	10	4	2		1					67
21	6	7	7	9	4	4		1					55
22													0
23	1	2	2		1		1						8
24	8	8	16	10	8	3	5	2	1				91
25	60	83	90	53	37	20	9	7	5				489
26	22	18	18	12	12	1	2	1					123
27	5	5	13	10	4	2	3	2					44
28	6	21	14	12	4	5	1	2					103
29	39	50	36	37	12	16	13	3	4				278
30	12	22	30	25	16	13	6	1	4				168
31	3	3	3	1	2	1							18
32	2	3	1	4		1							17
33	5	10	5	7	2	8	5		1				72
34	8	5	3	4	2	2	3		1				44
35	6	5	8	6	5	2	4		1				51
36	13	20	19	4	6	3	3	1		1			101
Tot.	381	540	493	384	200	140	87	40	21	2	1	0	3171

SUMMARY OF INFORMATION OBTAINED FROM A STUDY OF THE DATA

1. Total number of all types of high schools in the state which could be included in the study.....386

2. Number of high schools which failed to return data asked for and for which data could not be tabulated.....14

3. Number of high schools for which data were tabulated and including those which did not have football teams.....372

Percentage tabulated of the total number of high schools in the state.....96.37

4. Of the 386 high schools in the state:

91 schools did not have football teams;
295 schools had football teams;
14 schools having football teams—no tabulation made.

5. Out of the 281 schools recorded as having football teams:

190	schools reported 1 team
66	schools reported 2 teams
24	schools reported 3 teams
1	school reported 4 teams
281	schools reported 398 teams

6. Members of high school teams, possibly with very few exceptions, come from grades 9, 10, 11, and 12. The total regular enrollment, as of October 17, 1932, in grades 9, 10, 11, and 12 in the 386 high schools (See Table 1).....220,261 pupils

7. The total regular enrollment, as of October 17, 1932 in grades 9, 10, 11, and 12 for the 14 high schools which could not be tabulated .....9,597 pupils

8. The total regular enrollment, as of October 17, 1932, in grades 9, 10, 11, and 12 in the 372 schools tabulated.....210,664 pupils

Assuming one-half of these were boys, there were.....105,332 boys

9. The 372 high schools tabulated contained 95.64 per cent of the pupils in the 386 high schools in the state.

10. The 91 high schools which do not play football arranged in order according to enrollment are given in Table 2.

11. There were, in 281 schools tabulated, 13,559 boys who were members of high school football teams. Of these 3,003, or 22.15 per cent were reported injured, and 10,556, or 77.85 per cent were reported not injured. The number of boys not injured, the number of boys injured, the total number of boys who played, and the percentage injured out of the boys who played are given for each age group in the table. (See Table 3.)

12. The 3,003 boys injured received 3,171 injuries; 1,014 were Class "B" injuries and 2,157 were Class "A" injuries. Of the injuries, 31.97 per cent were Class "B" injuries. The number of Class "B" injuries,

the number of Class "A" injuries, the total number of injuries, and the per cent of Class "B" injuries out of the total number of injuries are given for each age group in the table. (See Table 4.)

13. Of the 160 boys who received more than one injury:

89 boys received 2 Class "A" injuries
28 boys received 1 Class "A" and 1 Class "B" injury
35 boys received 2 Class "B" injuries
5 boys received 3 Class "A" injuries
1 boy received 2 Class "A" and 1 Class "B" injuries
2 boys received 3 Class "B" injuries

14. The three most common injuries reported in order are: bruise, sprained ankle, and sprained knee. The frequency distributions of types of injuries, types of Class "A" injuries, and types of Class "B" injuries are given in Table 5.

15. Table 6 gives the number of injuries by types and age levels. Tables giving similar information for Class "A" and Class "B" injuries have been omitted as the distributions are much the same.

ADDITIONAL STUDY WOULD YIELD THE FOLLOWING INFORMATION

1. The relation of enrollment to number of players on teams.

2. The relation of number and nature of injuries, number and nature of Class "A" injuries, and number and nature of Class "B" injuries to school enrollment.

3. The number and nature of injuries, the number and nature of Class "A" injuries, and the number and nature of Class "B" injuries to number of players on the squad.

CONCLUSIONS

The following conclusions may be drawn:

1. The 91 California high schools which do not play interscholastic football have in most cases small enrollments. Sixty-two schools out of 91 have enrollments less than 100 pupils. Eighty schools out of the 91 have enrollments less than 150 pupils.

2. More high school boys 17 years and 0 months to 17 years and 5 months old played interscholastic football than at any other age. The incidence of injury also falls in this age group.

3. Aside from being bruised, boys playing interscholastic football are more apt to have a sprained ankle, sprained knee, or sprained shoulder than any other type of injury. More than half of all the injuries which occur are included in bruises, sprained ankles, sprained knees, and sprained shoulders.

4. If age is a factor in causing injuries it appears to be the range in age of players on teams rather than being a particular age.

5. There seems to be little relationship between age and seriousness of injury.

6. There seems to be little relationship between age and type of injury.

7. The percentage of boys injured out of the number of boys playing tends to increase with age. The greatest percentage of boys injured is found in connection with boys 20 years and 6 months to 20 years and 11 months old. It is generally true that older players spend more time playing in interschool games than younger players. This leads one to believe that number of minutes the boy plays along with other factors is of greater importance in causing injuries than the factor of age.[6]

8. Age of players is only one factor in the situation. The true relationship of age to number and nature of injuries cannot be determined accurately until the relationships of all other factors causing injuries are known.

9. This study has resulted in locating the problem. An enlarged study, including the relationships of all causal factors to injury, would be of assistance in our effort to reduce the number and seriousness of injuries to football players.

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[6] Some of the factors which cause injuries may be:

1. Condition of playing field.
2. Quality and quantity of personal equipment worn by player.
3. Physical and mental condition of player.
4. Knowledge player has of the game.
5. Competence of instructor.
6. Age range of players on teams.
7. Relative size of schools playing in the league.
8. Relative size of squads.
9. Competence of officials in the game.
10. Number of games in the schedule.
11. Weather conditions during the game.
12. Morale of the team.
13. Desire of the team and coach to win at all costs.
14. The number of minutes the player is in the game.
15. State of fatigue of player.

Survey of Football Injuries in the High Schools of Massachusetts

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FOOTBALL during the past two years has been the subject of considerable unfavorable publicity because of the tremendous cost associated with it of late years, "overemphasis," and more particularly because of the injuries and deaths resulting from it, especially during the season of 1931.

The subject of injuries is an old one. The writers well remember the hue and cry that went up in 1910 and 1911 over the number of deaths at that time. In the intervening years, the game has been opened up, bodily contacts of the old crushing, bruising type have been materially eliminated for the so-called "open game." Despite that, we still have a definite percentage of injuries and unfortunately a few deaths. After the disastrous season of 1931, a famous coach of a Western university made the following remark: "It just happens that there have been more accidents than usual. There is no denying the fact that football is a rough game; it always will be a rough game so long as its two greatest fundamentals are tackling and blocking, wherein players must meet each other in personal collisions. That sort of personal contact cannot be eliminated without entirely changing the nature of the game." The writers have spent many, many years in close contact with the game in all of its phases but more particularly with high school football. This four-year survey applies exclusively to high school play and it is their opinion that the number of injuries on a percentage basis during the football season has been very low.

Football, under proper supervision, gives boys a natural outlet for their nervous energies and keeps them off the streets, thereby avoiding other mishaps, such as automobile, motorcycle, and trolley-car injuries, and others too numerous to mention. In practically all of the schools, the boys are required to submit to a physical examination which removes those physically unfit, thereby eliminating many possible cardiacs, chest cases, and the like.

Inasmuch as individual ideas on this subject have been relative, the writers have undertaken the task of trying to find out just what the conditions are in Massachusetts with regard to high school football. For the past four years, data in the form of a survey have been collected with a view to finding out just what percentage of the boys receive injuries and of what these injuries consist. In this survey the following data were asked for:

(a) Number of boys on the squad.
(b) Number of injuries and nature thereof.
(c) Presence or absence of a doctor at the games.
(d) Number of boys in school permanently injured from accidents occurring in previous years.

Footnote: Please be explicit as to details, stating exact part of body, joints, or bones involved, with report of attending physician when possible.

This information has been sent in by school principals, physical directors, faculty managers, coaches, and in a few cases by school physicians.

The following figures show the number of schools heard from for the four years from 1929 to 1932 inclusive.

CHART I

	1929	1930	1931	1932
Number of schools	93	106	91	103
Number of Boston Schools	13	13	13	13

In addition, eleven schools reported that they did not support football. The average number of schools heard from (98) per year is well over two-thirds of the total number of schools in this state playing football. This means that sufficient data have been collected to give a fairly good cross section of high school play. In every way possible, the diagnoses have been corrected and checked, in many cases by talking with the attending physicians and in a few others by verifying through hospital records. There is a marked tendency on the part of some schools to exaggerate through mistaken diagnoses. That this is so, is partly explained by the difference in the percentage of the state as a whole and that of Boston schools as a unit. The latter group is very easily checked as most of it comes directly under the immediate supervision of the writers.

Following our 1929 report we received a report of a similar nature made by the physical director of high schools in Los Angeles, California, the essentials of which will be recorded later.

THE REPORT ON INJURIES

The outstanding item in these reports is the fact that there have been no fatal injuries in this entire period involving a little over 20,000 boys. This certainly speaks well for a game that in Massachusetts has had, according to figures, an average of 5,000 boys playing at least 5 days a

week over a period of 9 to 10 weeks. This fact no doubt maintains in the few schools not included in this report. During this 4-year period, 63 schools have submitted their reports annually and 37 others have registered for 3 years showing a continuity of statistical evidence. Altogether 122 schools were heard from once at least. In 1929 one boy died during the football season and the report went about it was a football death. This was denied by the school authorities, backed up by the three physicians attending the boy and by the boy's parents. In 1931 one of the Boston boys, a member of the second team, after football practice was over and the players had dressed to go home, dropped dead following an altercation with another boy. We feel that this had nothing to do directly with football and might have happened regardless of the game. In 1932 a student of a high school, ineligible for the school team, playing sand-lot football on a Sunday afternoon, received injuries from which he later died, namely a fractured skull. This brings out one of the points that we hope to show later. Only one boy is reported to have been permanently injured so that he could not play any more. This boy received a compound fracture of his elbow in 1929 and now has an ankylosed joint. The following is a copy of a statement received from one of the coaches representing one of the best high school teams in the state, "We had no injuries during the season except a few muscle bruises and according to the report of our truant officer, no member of the squad was absent from school on account of an injury received from football. We did, however, have seven fractures and dislocations from boys playing sand-lot or back-yard football. These boys were not members of the high school squad."

ANALYSIS OF INJURIES

Analyzing the injuries in detail we find the clavicle and nose among the bones most often injured. The shoulder is the large joint that is most often dislocated, with dislocations of the finger joints fairly common. Sprained ankles are by far the most common with injuries to the knee joint next in order. With regard to injuries to the semi-lunar cartilages of the knee, the following data may prove of interest. A series of fifty consecutive cases operated on at the Boston City Hospital showed the following causes and disclosed the rather amazing fact that there were eight females in this group.

CHART II

Walking—fell	13	Basketball	1
Football	8	Skiing	1
No cause stated	8	Baseball	1
Direct trauma	7	Jumping	1
Wrestling	3	Kicking	1
Climbing	2	Lifting	1
Wrenched knee	2	Gymnasium	1

As expected, the lower extremities including the hips receive the most trauma. There were no fractures of the hip, pelvis, or patella reported. Head injuries in the form of concussion do occur, but they are relatively mild, usually resulting in temporary derangement with a loss of memory for the immediate past. Many of these are very difficult, even for a doctor familiar with them, to diagnose for so many times boys are capable of fooling one. Very few of them require more than one night's care, not many of them requiring that much medical attention. In 1932 there was one fractured skull reported. This was a linear fracture of the parieto-occipital region and cleared up without any special complications. It was the only one reported in the entire period. There was one serious spinal injury, a fracture of the fifth and sixth cervical vertebrae with resulting paralysis to the hand and fingers. A check-up on this six months later showed the boy back to normal with absolutely no nerve changes anywhere.

The following is a detailed report of the more serious injuries as reported in this four-year period.

CHART III

	1929	1930	1931	1932
Concussions	20	17	21	23
Fractures				
Arm (a) Humerus		1	2	4
(b) Ulna		2	2	2
(c) Radius	22	3	2	3
(d) Wrist		8	14	9
(e) Both Bones		4	1	1
Hand	14	5	15	5
Fingers	7	8	15	10
Jaw	2	1	1	1
Clavicle	29	31	32	26
Malar	0	1	0	3
Nose	38	28	37	25
Vertebrae (Trans. Proc.)	2	2	4 (1 body)	1
Skull	0	0	0	1
Leg (a) Femur	2	1	1	0
(b) Tibia			2	3
(c) Fibula			10	10
(d) Both Bones	20	5	2	2
(e) Foot			3	4
(f) Unqualified		6	2	6
Ribs	1	5	3	3
Dislocations				
(a) Shoulder	15	14	18	13
(b) Elbow	6	1	9	0
(c) Fingers	18	10	3	4
(d) Unqualified	0	11	3	2
(e) Acrom. clavicle Sep.	1	3	2	5

There are usually a few injuries of an unusual nature resulting from trauma such as a contused kidney with hematuria, myositis ossificans most often in the thigh muscles but in one case in the rectus abdominus

muscle. Infections from abrasions often result in extensive loss of time with hospitalization in a few cases. Infected blisters on the heels, abrasions on the calves of the legs, increased perchance by the tendency of late years to abandon stockings, are the most commonly seen. "Athletes' foot" is a prolific source of trouble occasionally and becomes very epidemic once started in a squad. Most of these infections are unnecessary and could be eliminated with a little attention by a competent person at their origin. Fractures of the transverse processes of the lumbar spine, while not common, do occur, to wit, two cases each year. We believe these have been overlooked in days gone by, but are more often recognized today, thanks to the X-ray and the knowledge that they exist. As a rule they are not as serious as many would try to make out. We recall a boy who went through a season many years ago with practically no treatment for the same, and with no bad after-effects. Fractures of the vertebral body occurred only once in this period. Strange as it may seem, in 1931 one school reported an average gain for the squad of four and one-half pounds for the season.

INJURIES IN TWO CLASSES

The injuries were divided into two classes: *Major* (including all fractures, dislocations, concussions, or other serious accidents); and *Minor* (including all the rest, i.e., lacerations, contusions, sprains, etc.).

CHART IV

					Boston Schools		
	1929	1930	1931	1932	1930	1931	1932
Number of Boys	4,319	5,456	4,616	5,980	790	699	851
Number of Schools	93	106	92	103	13	13	13
Number of Injuries	504	549	528	543	56	61	68
Number of Major Injuries	199	175	212	171	13	17	12
Number of Minor Injuries	305	374	316	372	43	44	56
Percentage of Injuries	11.4	10	11.4	9.1	7.1	8.7	8
Percentage of Major Injuries	4.8	3.2	4.6	2.8	1.6	2.4	1.4

In 1929 the Los Angeles High Schools (29 in all) showed 2,160 boys on the squads, with a percentage of major injuries of 1.5 per cent. This latter figure compares very closely with the average for the Boston schools. Both of them are probably very accurate because of the opportunity to check them up.

Further analysis of the records shows a decided difference in the percentage of injuries in schools having squads of fifty or more boys as against squads of fifty or less.

CHART V

	1930	1931	1932
Squads of 50 or more	38	37	48
Number with attending physician	35	31	42
Percentage of injuries	7.3	9.3	7.6
Squads of 50 or less	68	55	55
Number with attending physician	29	24	28
Percentage of injuries	13.5	14.1	13.5

From the above chart it is obvious that the smaller schools have almost twice as many injuries as the larger ones, and that the number having physicians at their games are proportionately smaller. This latter fact undoubtedly has something to do with the number of injuries although the better part of the explanation is probably found in the lack of substitutes and in playing against teams of superior strength, ability, and numbers.

MEDICAL ATTENDANCE AT GAMES

We have presented figures with regard to the medical attendance at the games. In many districts it is mandatory that a doctor be present at all games. In the Suburban League just outside of Boston, most of the schools require a doctor at all practice sessions when scrimmaging takes place. In Boston, a doctor attends all the games whether between Boston schools or between a Boston school and an outside school.

We believe that a doctor should be present at all games, preferably one who is familiar with athletic injuries, and that those in charge of the football régime should provide one. The doctor should be the sole judge of who should continue in play and who should not. He should be given authority to remove anyone from the game at any time. In the Boston schools all injured players are seen on the field of play by the attending physician and his decision with regard to the boy's continuance in the game is absolute. To some this may seem a very radical procedure but it has proven very effective over a period of thirteen years. The *Journal of the American Medical Association* editorially late in December, 1931, wrote as follows: "How amusing, if not actually pathetic, is the picture thus raised of physicians pacing up and down the field awaiting the football casualties as the army surgeon awaits the wounded in actual warfare. Even in war humanity protests against the return of men to the front until they have recovered from their wounds. How often is a limping football player returned to the play with an encouraging and admonishing slap on the back by the coach who 'needs him' in the game. In everyday life even slight injuries are given full opportunity to be repaired. The modern football crowd shrieks for the injured players to 'stick it out.' The athletic directors and the coaches are the big business men of modern football. From them emanate the rules under which the game is played. To them the players must look for protection against 'rabbit punches,' 'clipping,' illegal blocking, flying tackles, mass plays, and similar hazards. The injured player may wish in the heat of the conflict, to hazard his life and his health. The burden rests on the coach, the captain, and the officials to see to it that the player is not permitted to do so."

A physician, familiar with athletic injuries, armed with absolute power over all players will do more for the welfare and protection of players than can ever be provided by rules and regulations. It is just be-

cause this authority and protection is lacking that many players are returned long before they are physically in condition to do so. A good substitute is a far better player than an injured "star." A physician, doing his work well, should not be influenced by the game, the crowd, the victory, or anything else except the condition of the player.

Dislocations occur every year and these readily recognized can as a rule be reduced provided the diagnosis is quickly made and the reduction carried out at once. One of the writers has reduced one or more dislocations per year involving the shoulder and elbow without the use of an anesthetic. This was accomplished on the side of the field, thereby relieving the pain, spasm, and hemorrhage at once, to say nothing of the discomfiting trip to the hospital. Head injuries are often very hard to diagnose in their milder forms and often one familiar with them is easily fooled by some clever boy. They constitute a group that if not promptly and adequately treated very often lead to serious injuries. With the new ruling relative to substitutions, there is no longer any excuse for keeping a boy in a game who is obviously not up to par physically at that particular time. This applies particularly to head injuries where a few extra minutes might completely restore a boy to normal.

It has been our practice not to use aromatic spirits of ammonia to revive boys. Fractures of the milder type can often be diagnosed and placed in a portable splint. Abrasions and lacerations can be given immediate and adequate first-aid treatment and, in the cases where boys are to continue in play, can be properly protected from additional trauma and possible infection. Athletic injuries in contrast to other types such as automobile injuries are in a class by themselves and are best treated as a rule by doctors familiar with them. Proper strapping and proper application of pads and bandages require a special knowledge and technique with which every doctor attempting to look after the welfare of these boys should be familiar.

INJURIES NOT COMMON

Some schools have refrained from maintaining football teams on the grounds of expense and loss of time from school. The question of expense is not within the purpose of this paper. It is true that football does cause loss of time for certain individuals, but we do not believe that is as great as many imagine it to be. Boys of high school age are young, active, daring, and are constantly exposing themselves to danger just as much off the football field as on it. Over a four-year period there has not been a fatal accident in Massachusetts, only one fractured skull, and only one fracture of the vertebral column causing any serious trouble.

There are a great many injuries, serious and otherwise, associated with unorganized football that the organized game gets credit for. Boys obviously out of condition physically, under no supervision, playing under poor conditions as to field, spectators, and officials, receive injuries

and it all goes under the heading of football. This is obviously wrong and should be eliminated from consideration when speaking of injuries under a well managed system. We believe that the facts speak for themselves and that if the figures are properly analyzed, the injuries received in playing high school football are not particularly serious or common.

We believe that every boy so desirous and physically qualified after proper medical inspection should be allowed the privilege of playing football and that the game is not as harmful as painted. The fact that two large cities on different sides of the continent show such similar statistics and such good results, speaks well for a sport that provides out-of-door recreation for over five thousand boys per season in Massachusetts.

CONCLUSIONS

From the results of this study the following recommendations can be made. There should be:

1. Better officiating particularly with a view to eliminating the rougher aspects of the game, especially the "under the pile" tactics of certain players. Officials should have the game in hand at all times and should not be slow in penalizing offending players.

2. Proper schedules with boys playing in their own class as to size, age, weight, etc.; also games should not be arranged too close together. One game a week should be enough for the average high school player. Failure to observe this custom is apt to lead to overfatigue and cardiac strain.

3. Proper protection for all players with compulsory wearing of headguards. We personally feel that the practice of late years of playing without stockings is not a particularly good one.

4. Suitable field and playing surfaces at all times with the elimination of skin diamonds, baseball fields, and the like. Dirt fields heavily laden with dust are very bad at all times.

5. Proper conditioning of boys at all times and especially early in the season.

6. Medical attendance at all games with a physician as the sole judge of who is to continue in the game.

Summary.—Under proper supervision on a good field with a doctor present to supervise all injured players, with properly arranged schedules under moderately good weather conditions, and with proper officials, we believe that football as played in the high schools today is certainly worth while and that the personal liability has been reduced to a very low figure.

An Objective Method of Measuring the Height of the Longitudinal Arch in Foot Examinations

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INTRODUCTION

LESS has been done to measure the feet objectively than any other body function or structure subject to improvement through physical exercise or rest. Until recently foot examinations largely consisted of a subjective checking of certain foot characteristics that are indicative of the status of the foot. Stafford [1] lists twelve points that characterize the normal foot. Phelps and Kiphuth [2] lay great stress on the line of the heel cord, believing that the flattening of the longitudinal arch always accompanies pronation of the foot. If this line is perpendicular and bisects the middle of the heel, then pronation is not present to any important degree. The degree of pronation may be judged by the curve of the heel cord inward. The fluoroscope has been used by some, but this type of examination does not seem practical from the standpoint of the physical educator.

The above methods of examining the feet have not been proven for objectivity, nor have norms been established. But what is more important, they do not give the physical educator a permanent record of the status of the foot at any one time. When re-examining after treating the foot for a period of time, it is difficult to remember the exact condition of the foot at the beginning. Consequently, it is difficult to judge the degree of foot improvement, or, in fact, if any improvement has taken place.

An attempt to measure feet objectively has been made by Lowman, Colestock, and Cooper [3] who propose three measures, indicating first, second, and third degree depression of the longitudinal arch. This test is based on measuring the distance the scaphoid bone is below an imaginary line drawn from the internal maleolus to the prominence of the big toe. In a first degree foot, the scaphoid is one inch below the line;

[1] George T. Stafford. *Corrective and Preventive Physical Education*, p. 185. A. S. Barnes & Co., 1928.
[2] W. M. Phelps, and R. J. H. Kiphuth. *The Diagnosis and Treatment of Postural Defects*, p. 106. C. Thomas, 1932.
[3] C. L. Lowman, Claire Colestock, and Hazel Cooper. *Corrective Physical Education for Groups*, p. 43. A. S. Barnes, 1928.

in second degree, it is two inches below; and in third degree, three inches below.

The validity of this test has been questioned by Rogers who states that the suggested method of measurement is not adjusted to differences in the size of feet. "A sixty-pound child with flat feet might be classed as first degree, and a six-foot, four inches tall 'carnivorous type' man classed as second degree even though he had relatively high arches." [4] Also, the degree of reliability and objectivity is not established.

THE USE OF THE FOOTPRINT IN FOOT EXAMINATIONS

The footprint as a measure of foot conditions has been in use for some time. Properly taken, it shows the *height of the longitudinal arch.* In the complete foot examination, however, it must be supplemented by other methods of examination. It should be understood throughout this presentation that the footprint is not intended to measure such foot defects as metatarsalgia, hallux valgus, depressed metatarsal arch, etc. These conditions should be determined by other examination procedures in addition to the footprint test.

Phelps and Kiphuth [5] attack the use of footprints on the ground that it is possible for a normal foot to give an impression of being flat by increasing the amount of pronation, and that a flat-footed individual may produce a nearly normal print by supinating the foot. This condition would be true to a certain extent when foot examinations are given carelessly. However, when the examiner uses a pedograph machine and is careful with his procedures, it has been the writer's experience that individuals who are not making an "honest" print may be detected and corrected.

Footprints may be made with home-made devices. McKenzie [6] describes a method which consists of preparing the following solution: 55 per cent tincture of ferric chloride, 40 per cent glycerine, and 5 per cent alcohol. By means of a brush or cotton-wool wrapped on a small stick, paint the sole of the foot with this solution, place the patient's foot on a sheet of paper, having him put the full weight down upon it. Brush the resulting print with a 20 per cent solution of tannic acid, and the tracing becomes dark and legible.

Several commercial organizations, however, provide materials for footprints. The pedograph machine [7] for making footprints is inexpensive and convenient. This device is used widely by shoe salesmen as an aid in fitting feet. Physical educators may also utilize it as an aid in detecting and measuring the change in the longitudinal arches of the feet of pupils in their classes.

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[4] Frederick Rand Rogers. *Fundamental Administrative Measures in Physical Education*, p. 155. Pleiades Co., 1932.

[5] W. M. Phelps, and R. J. H. Kiphuth, *op. cit.*, page 105.

[6] R. Tait McKenzie. *Exercise in Education and Medicine*, page 394. W. B. Saunders Co., 1924.

[7] Manufactured by the Scholl Mfg. Co., 62 West 14th Street, New York City.

THE FOOTPRINT ANGLE

The first attempt to measure footprints was made by Schwartz [8] who originated the footprint angle. This angle is the chief mathematical measure of foot conditions available from footprints. One method of scoring the footprint is shown in Figure I. This angle is based on the theory that as arches are strengthened, arch-angles increase steadily. Rogers [9] has also experimented with the footprint angle. Schwartz secured a reliability coefficient of .91 for 93 cases, while Rogers secured a coefficient of .92 for 142 cases. Neither writer, however, gives objectivity for the measurement. Rogers states that "experience and judgment are necessary to determine placement of lines to form arch-angles." [10]

It is thought by the writer that the reason for this lack of objectivity is due to a looseness in defining one of the lines that constitutes the angle to be measured. This line, which corresponds to line "C" in Figure I, is defined as a "line of best fit," or one which best represents the slope of the arch. This definition allows for considerable judgment on the part of the measurer in placing the line, and causes disagreement between examiners. This difficulty, however, is experienced chiefly in scoring the higher arch angles.

The writer believes that the footprint measurement would become a more useful tool for physical educators if this "line of best fit" was definitely defined. It is the purpose of this research, therefore, to so define that line.

INSTRUCTIONS FOR MAKING FOOTPRINTS WITH THE PEDOGRAPH MACHINE

To aid in securing reliability and objectivity for the footprint measurement, the following standardized procedures are listed for making footprints with the pedograph machine.

1. All subjects should be tested with their feet bare.

2. The examiner should make sure that the pedograph machine is properly inked so that it takes a clear, even imprint before giving any tests. Re-ink the pedograph as often as it becomes necessary. Approximately fifty imprints can be taken from one inking of the machine.

3. Place a number of sheets of footprint paper in the pedograph box to hold them properly.

4. Cover the top paper with the stamping cover.

5. Instruct the subject to place his bare heel against the steel plate of the pedograph machine without allowing the foot to touch the stamping cover. When the subject's foot is in the proper position, instruct him to stand firmly on the stamping cover without wobbling or rocking, and to remove the opposite foot from the floor so that the foot being tested receives the full weight of the body.

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[8] Lows Schwartz, R. H. Britten, and L. R. Thompson. *Studies in Physical Development and Posture*, page 23. U. S. Public Health Bulletin, No. 179, 1928.

[9] F. R. Rogers, *op. cit.*, page 99.

[10] F. R. Rogers, *op. cit.*, page 149.

Be sure that each subject places his foot squarely on the stamping cover, so that an honest print of each foot tested is obtained.

6. When the subject steps off the stamping cover, remove it and the sheet marked with the footprint.

7. Mark the sheet with the subject's name and date of the print.

8. Repeat with the other foot.

INSTRUCTIONS FOR SCORING FOOTPRINTS

Score each footprint by ruling off lines as illustrated in Figure I, and measure the angle between them. Directions for this scoring are as follows:

1. Draw line "A" to represent the medial border of the foot between the points of the imprint at the base of the first metatarsal bone (base of the big toe) and the calcaneus or heel bone.

2. Draw line "B" to represent the slope of the inner segment of the longitudinal arch at its junction with the metatarsal border of the arch.

3. Locate points "x" and "y." "X" is located at the point where line "A" first touches the imprint. "Y" is located at the point where line "B" first touches the metatarsal border of the arch.

4. Draw line "C" between points "x" and "y." This line is intended to represent the slope of the metatarsal border of the longitudinal arch.

5. Measure the angle at the junction of the lines "A" and "C" with a protractor.

FIGURE I

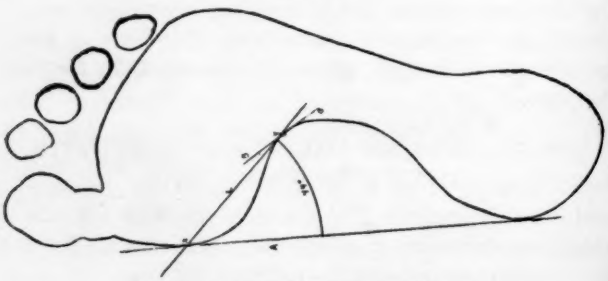


DIAGRAM OF THE FOOTPRINT ANGLE

A discussion of the scoring of the footprints in Illustrations 1, 2, 3, and 4 will aid the examiner in measuring various types of prints encountered. The greatest difficulty in making the footprint measurement is to place line "B" described above. Special reference will be given this line in commenting on the illustrations given.

Illustration 1 is a footprint that measures 42 degrees, and is representative of the median foot determined in this study.

Illustration 2 is a high arch and shows the arch of the external border of the foot. This print is difficult to measure. Point "y," however, should be placed as high as the print will allow.

Illustration 3 is a low arch of 16 degrees. Line "B" merely touches the arch at the point where the flatness of the foot is first indicated.

ILLUSTRATION 1

ILLUSTRATION 2

ILLUSTRATION 3

ILLUSTRATION 4

ILLUSTRATIONS OF THE FOOTPRINT ANGLE WITH DIFFERENT TYPES OF FOOTPRINTS

Illustration 4 indicates a problem. Line "B" is drawn at a peculiar slope. One might easily draw it in the position indicated by the dotted line. When in doubt as to where to place this line remember that the desired position for line "C" is one that best represents the slope of the metatarsal border of the longitudinal arch. With this in mind the question is easily answered.

STATISTICAL PROCEDURES AND RESULTS

Validity.—A perfectly valid test is one which measures exactly that which it is intended to measure.[11] Validity may be determined by computing measures with other evidences of the qualities they are to measure.[12] If one wishes to construct a test of physical fitness, he has available as criteria, with which to validate his test, a standardized test of physical fitness.[13] If one wishes to construct a test of motor ability, he has available a previously established test measuring motor ability with which to compare his new test.[14] For measuring the height of the longitudinal arch, however, there are no scientifically prepared tests which can be used as a basis of comparison, i.e., for validating new tests. Other criteria of validity must be found.

In experimenting with validity for the footprint angle, the writer used judgment ratings in the following manner: (1) Seventy-five footprints were taken from a random sampling in the physical education classes at Syracuse University by both the writer and an assistant.[15] (2) The feet of these same students were then judged by both testers for the height of the longitudinal arch. (3) Finally, correlations were computed between the judgment ratings, the footprints, and the footprints and judgment ratings.

The correlation coefficients were as follows:

	r
Writer's scoring of footprints with assistant's scoring of footprints ...	.968
Writer's subjective judgment with assistant's subjective judgment ...	.896
Writer's scoring of footprints with writer's subjective judgment	.743
Assistant's scoring of footprints with assistant's subjective judgment	.702

It should be pointed out that the criterion of validity itself is indefinite. There is likely to be more or less great error in any criterion which is subjective, such as the writer's or any physician's opinion. Standard tests of intelligence only correlate .46 with teachers' ratings of intelligence.[16] Franzen[17] found that the correlation coefficients be-

[11] William A. McCall. *How to Measure in Education*, p. 195. Macmillan Co., 1922.
[12] F. R. Rogers, *op. cit.*, p. 15.
[13] F. R. Rogers. *Tests and Measurement Programs in the Re-direction of Physical Education.* Bureau of Publications, Columbia University, 1927.
[14] D. K. Brace. *Measuring Motor Ability.* A. S. Barnes & Co., 1930.
[15] The assistant was a senior student who had assisted with corrective work at the University during the year.
[16] Reported by F. R. Rogers, *op. cit.*, p. 125.
[17] Raymond Franzen. *Physical Measures of Growth and Nutrition.* American Child Health Association, 1929.

tween physicians' judgment of nutritional status ranged from .18 to .82; the median between any two physicians was .60. These examples indicate the uncertain and indefinite quality of judgments as a criteria on which to base validity.

As a matter of fact, it may be observed that only that part of the foot which comes in contact with the floor in weight-bearing makes an imprint in testing with the pedograph machine. Also, it is a matter of observation that as arches are strengthened, arch-angles increase steadily, while the reverse is true when arches are breaking down.

The whole concept of foot measurements is new. Since objective criteria for validity is indefinite, objective tests susceptible of interpretation in mathematical terms may be considered the point of departure in measurement. It may possibly be concluded, therefore, that the footprint angle developed in this research may be considered to be the proper criteria for evaluating any subsequent tests or any substitute.

Reliability.—"A measure is reliable if two or more measures of the same object or function by the same measuring device yield the same scores." [18] Thus to determine the reliability of a test, it is necessary to perform the test with a group on one occasion, and then at another time repeat the procedure with identically the same group. A correlation is then computed between the results of the two tests.

How high should this correlation be? The answer to this question has only been given in an approximate fashion. Ruch and Stoddard [19] suggest that reliability coefficients between .95 and .99 are very high and "rarely found among present tests." According to Garrett,[20] most makers of general intelligence tests demand a reliability coefficient of at least .90.

In computing the reliability coefficient for the footprint angle described in this experiment, 135 footprints were taken from a random sampling of students in the physical education classes at Syracuse University. The reliability coefficient computed from duplicate tests of this group was .971. The range of scores was from 0° to 61°. From the foregoing criteria of the degree of reliability, it may be concluded that the reliability of the footprint angle is high.

Objectivity.—By objectivity is meant the degree of uniformity with which various teachers may score the same test.[21] In other words, a measure is objective if two or more measurers, using the same procedures, secure similar results. Objectivity is not important if the measurer is using his results for his own use. In this case, reliability is

[18] F. R. Rogers, *op. cit.*, p. 17.

[19] G. M. Ruch and G. D. Stoddard. *Tests and Measurements in High School Instruction*, p. 54. World Book Co., 1927.

[20] H. E. Garrett. *Statistics in Education and Psychology*, p. 269. Longmans, Green & Co., 1926.

[21] J. F. Bovard and F. W. Cozens. *Tests and Measurements in Physical Education*, p. 235. W. B. Saunders Co., 1930.

sufficient. However, if he intends to compare his results with those of other testers, or to compare his results with norms established by others, objectivity is extremely important and essential.[22]

To secure objectivity for the footprint angle, the writer correlated his results of testing a number of feet with those of two other testers, who measured the same feet.[23] Thus an objectivity coefficient was secured. The first of these measurers was a senior student in physical education who has been assisting with corrective work at Syracuse University during the year. The second is a graduate student.

With 75 prints, one examiner correlated .968 with the writer, while the objectivity correlation between the second and the writer was .901 for 35 cases. The first tester was given special training for his task, while the latter received instructions only. The correlation between both examiners combined and the writer was .947. These correlations indicate high objectivity for the footprint angle.

Norms.—Norms for the footprint angle have not been well established. Schwartz [24] reports that the average angle by his method of measuring is "about 45°," while Rogers [25] found a median for 300-odd prints taken from high school and university students of 42.21°. Rogers concludes, however, that a tentative norm for footprints may be set at 40°, since the group from which his prints were obtained were rather highly selected. He also suggests that pupils with angles below 30° may usually be considered to be proper subjects for individual foot corrections.

One part of the study made by the writer was to score 518 footprints of entering men students at Syracuse University at the time of their physical and medical examinations. The median score of this group was 42.08°. The mean was 40.07° ± .32. The range was from 0° to 64° with a standard deviation of 10.88°. The lower quartile was 34.65° and the upper quartile 47.77°. The correlation coefficient between right and left feet was .825 ± .02.

Tentative norms for the footprint angle for men described in this research may be considered as follows: The average, or norm, for college freshmen may be considered as 42°. Individuals with angles below 30° may definitely be considered as proper subjects for individual foot corrections. Students with angles between 30° and 35° may be considered as border-line cases, and should be given a re-examination to determine the possible need for corrective treatment. The data available for this experiment were insufficient to determine the effects of age, sex, or weight on footprint angles. It should be noted that individuals with normally high

[22] F. R. Rogers, *op. cit.*, p. 19.

[23] The writer wishes to acknowledge the assistance of Harold Button and Louis Nicolello, students in physical education at Syracuse University, in securing objectivity for the footprint angle.

[24] Lows Schwartz, *et al.*, *op. cit.*, p. 23.

[25] F. R. Rogers, *op. cit.*, p. 155.

arches that are weakening are not detected by this examination procedure until the arch angles reach the lower norm.

One possible defect of the footprint angle developed in this study is the difficulty experienced in scoring the higher arch-angles. The range of scores for the lower 50 per cent of the cases is between 0° and 42°, or 42°, while the range of scores for the upper 50 per cent is between 42° and 64°, or 22°. Another indication of the bunching of the scores at the upper end of the scale is the placement of the quartiles. The lower quartile is 7.43° removed from the median, while the upper quartile is removed only 5.69°. This also indicates the actual spread of the middle 50 per cent of the scores.

From the point of view of the educator, however, the higher arch-angles are unimportant, as they represent conditions not requiring treatment. Schwartz[26] says that variation in the angle above 50° is probably without meaning. In this experiment, a normal distribution of scores was sacrificed for objectivity. In the angle reported by Schwartz and Rogers, experience and judgment are necessary to determine placement of lines to form arch-angles. The expressed purpose of this study was to so define the lines forming the angle that the scoring of footprints would become objective. The objectivity coefficient of .968 indicates that this purpose was achieved.

THE VALUE OF THE FOOTPRINT ANGLE

The high reliability and objectivity of the footprint angle renders this measurement extremely valuable in determining the results of educational programs. As flat feet are strengthened, arch-angles increase steadily. An arch-angle of 15° at the beginning of treatment and 35° at the end represents a distinct improvement in the foot. Thus, the results of foot treatment can definitely be measured, as well as the determination of the immediate status of the arch at any time. The footprint itself is a motivating device. Like the silhouette in posture training, it portrays to the individual his condition and he can actually see improvement, or the reverse as the case may be.

[26] Lows Schwartz, *et. al., op. cit.*, p. 23.

Growth Comparison of Athletes and Non-Athletes*

By Floyd A. Rowe
Directing Supervisor, Bureau of Physical Welfare, Public Schools, Cleveland, Ohio

ARISTOTLE, in *The Politics*, written between the years 344 B.C. and 342 B.C., in Book Eight has, as a part of his remarks on gymnastic exercises in education, the following to say:

"It is an admitted principle, that gymnastic exercises should be employed in education, and that for children they should be of a lighter kind, avoiding severe regimen or painful toil lest the growth of the body be impaired. The evil of excessive training in early years is strikingly proved by the example of the Olympic victors; for not more than two or three of them have gained a prize both as boys and as men; their early training and severe gymnastic exercises exhausted their constitutions. When boyhood is over, three years should be spent in other studies; the period of life which follows may then be devoted to hard exercise and strict regimen. Men ought not to labor at the same time with their minds and with their bodies; for the two kinds of labor are opposed to one another, the labor of the body impedes the mind, and the labor of the mind the body."

There is no indication of lack of actual knowledge here. Aristotle does not avail himself of the safeguards of the modern scientist possibly because statistical procedure was unknown. He says:

1. "Avoiding severe regimen or painful toil lest the growth of the body be impaired."

2. "Early training and severe gymnastic exercises exhausted their constitutions."

3. "When boyhood is over, three years should be spent in other studies; the period of life which follows may then be devoted to hard exercise and strict regimen."

In his book *Greek Athletic Sports and Festivals* Gardiner tells us that the approximate age of the boy in Olympic competition must have been between the years of fourteen and sixteen—this because the boy was deemed a young man upon the appearance of the beard. In the Olympic games of ancient Greece the division between boys' and men's events was based upon the ability of the individual to grow a beard. This, then, fixes the age of the boy at about our junior high school level.

* Paper presented at the American Physical Education Convention, Research Section, Louisville, Kentucky, April, 1933.

In order to gain a more complete idea of the weight of these remarks of Aristotle in regard to the matter of the growth item and the influence of early competition on later competition, one should briefly review the early history of the Olympic games.

Gardiner further says, "The athletic records of Olympia date from the year 776 B.C., the 28th Olympiad from the organization of the games (by Iphitus). This Olympiad (in which Coroebus of Elis won the foot-race) is counted as the first Olympiad in the Olympic register, and from this date we have a complete list of winners (in this race copied by Eusebius) from the work of Julius Africanus, who brought the register down to the year 217 A.D. The register was originally compiled by Hippias of Elis at the close of the fifth century. It was revised and brought up to date by various writers from *Aristotle* (and Philochorus down to Phlegon of Tralles in the time of Hadrian) to Julius Africanus in the third century A.D."

Taking the date of the writing of Book Eight on *The Politics* as 344 B.C., and considering the fact that prior to that time Aristotle had engaged himself in bringing up to date the list of winners of the Olympic games dating from 776 B.C., one finds there a period of 432 years, or 108 Olympiads. Such records as were available had been carefully studied by Aristotle and were no doubt the basis for his remarks, "The evil of excessive training in early years is strikingly proved by the example of the Olympic victors; for not more than two or three of them have gained a prize both as boys and as men; their early training and severe gymnastic exercises exhausted their constitutions."

There are no records available in modern athletics over a period of 432 years, and for that reason some careful attention should be paid to this statement of Aristotle, especially in light of the fact that interschool athletic competition in public and private secondary schools is being promoted for boys, and girls too as far as that is concerned, of younger groups.

So far then as any further remarks coming from any authoritative source regarding the effect of a too early competition upon later competition is concerned, none seems to be evidenced in the literature between the date 344 B.C. and the present time—a period of some twenty-two hundred or twenty-three hundred years.

THE problem about to be discussed, then, relates to the effect interschool competitive athletics have upon the growth of junior high school boys in Cleveland.

Acting upon a rather remote suggestion that athletic competition might possibly influence the growth rate of boys taking part in them, a questionnaire was gotten out to the teachers of physical education in junior and senior high schools. The teachers were asked to report on the height and weight increases of boys on football squads and also on a comparable group of boys not taking part in football.

The result of this investigation showed in a crude way, and particularly

in junior high school, that boys taking part in football (and we play *touch* not the regulation game) did not grow either in height or weight as much as did boys who only took part in the required physical education program. There appeared to be without question an appreciable slowing up of the growth process for the boys taking part in athletics during the period of competition, as compared with boys not so taking part. This slowing up of growth processes was sufficiently large so that it was a measurable thing, both for increase in height and increase in weight.

Another noticeable fact was that more boys taking part in athletics lost weight, and that they lost more weight than did the boys of the non-athletic group. The change in rate of growth in senior high school, while noticeable, was not as marked as it was in junior high school. This difference no doubt is explained by the fact that the older boys are nearer their maximum sizes and the rate of growth is not as great as in the younger "teen" age boys, the growth curve of either weight or height flattening out in general as the boys reach maturity. The gross records coming in from all the schools, however, were not sufficiently accurate as to warrant the placing of a great deal of dependence upon them, since in some instances the checking of height and weight had no doubt been left to boys and some rather apparent inaccuracies appeared.

Records were next taken of the boys taking part in athletics as opposed to those not active in athletics in junior high schools only. The importance of accuracy was stressed and, in carefully checking the results turned in, the reports from three schools contained no discoverable inaccuracies. This group consisted of sixty-seven boys in the athletic group and sixty-five boys in the non-athletic group, paired according to weight and height at the beginning of the study.

From these two groups, it was discovered that between the period from September 1 to December 1, the sixty-five non-athletic boys gained in weight an average of 3.15 pounds per boy and gained in height an average of 35/100 of an inch, just over one-third of an inch. The group of sixty-seven boys competing in athletics gained on the average of 1.18 pounds per boy and gained in height an average of 28/100 of an inch, just over one-quarter of an inch. These figures are gross figures covering boys of all ages, sizes, etc., and for that reason are possibly not particularly impressive, although certainly they are highly suggestive.

THE next step in the investigation consisted of a study of two groups, one of twenty-five boys and the other of twenty-eight boys, observed very carefully over the period from September 23 to December 2. The results obtained checked with those first quoted; namely, a substantial positive increase in growth as measured by weight and height for the non-athletic group as compared with the athletic.

Following this study attention was directed to a study by Boas who

points out that there is a different growth rate for boys of the same age but of different initial heights.

The experiment was therefore continued in a school where the boys in the two groups were carefully equated as follows. Each of the boys competing in athletics was matched with a boy not in athletics on the following points at the beginning of the experiment: age, weight, height, and P.L.R. (Probable Learning Rate—equivalent to I.Q.), thus eliminating in large measure the problem of the influence of age, weight, and height on growth, as suggested by Boas. That is, one boy 17 years old weighing 150 lbs., being 65 inches tall, probably does not have the same probability of growth as has a boy aged 17 years, weighing 120 lbs., and being 60 inches tall. An attempt was made as described above to hold constant experimentally, not statistically, the three items of age, weight, and height. The average gain for the group of boys in athletics was 1.06 lbs.; the average gain for the boys not in athletics was 2.43. Again a positive height increment was discovered in favor of the non-athletic boys.

THREE items were considered in the data next presented which were collected by Mr. Riley of Fairmount Junior High School. They were: weight, height, and lung capacity. The following data are presented for all the boys over the total three-year period. Because the school is a small one, and population shifting, the final groups contained only some thirty boys each. While a highly selected group, this may be considered representative nevertheless.

Your attention is directed to the known and recorded fact that the boys under observation were either participants or non-participants in athletics for the entire three-year period. This item is of importance.

Considering, first, *weight*—the average increase in weight per boy for the athletic group for the three year period was 23.7 lbs., while that of non-athletic boys was 30.85 lbs.

Regarding the *height* increase as between the non-athletic group and the athletic group over the three-year period, Riley finds the average increment in growth in height for the non-athletic group 3.79″, while for the athletic group he finds 1.85″.

Considering now, *lung capacity*, the average increase in lung capacity over the three-year period for the athletic group is 37.9 units. The increase for the non-athletic group was 54.5 units.

When the average ages of the two groups of boys were considered, it was discovered that there was exactly one year's difference between the averages of the groups. The average age of boys taking part in athletics was 16 years and 8 months, while the average age of the boys not taking part in athletics was 15 years and 8 months—this at the end of the three-year period. Therefore, in order to equate the ages experimentally, the growth data for the first year of the boys not taking part in athletics were

13.8 15.8

eliminated and compared with the growth data of the same items for the first two years of the boys participating in athletics. This means then that the following data apply to two groups of boys—one taking part in athletics, and one not taking part in athletics, but over the same *two-year* age period, namely 13 years and 8 months to 15 years and 8 months.

So far as weight is concerned, it is discovered that the non-athletic group gained 18.65 pounds and the athletic group gained 17.75 pounds. Treating these data as described before, that is, securing the standard deviation of the differences of the averages and dividing the actual difference of the averages by the standard deviation of the difference of the averages, there would be found to be a difference in weight growth in favor of the non-athletic group 85 times out of 100. The formulas used for all computations are:

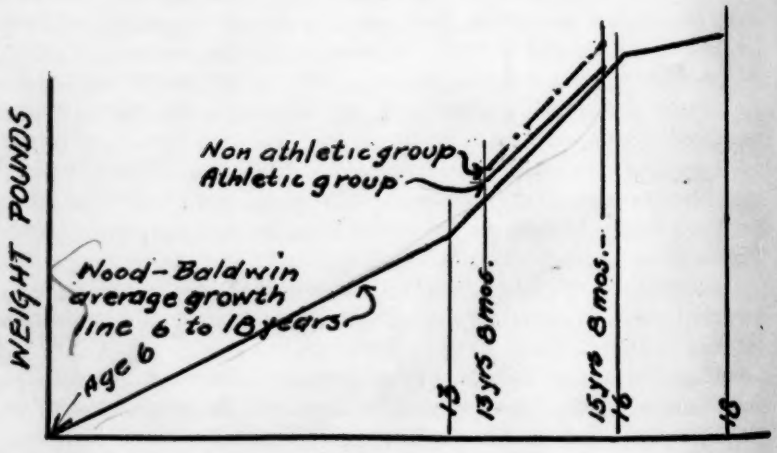
$$\text{Standard Deviation or } \sigma \text{ (sigma)} = \sqrt{\frac{\Sigma D^2}{N}}$$

$$\text{Standard Error of Average or } \sigma \text{ (avg)} = \frac{\sigma}{\sqrt{N}}$$

$$\text{Reliability of Difference between two averages or } \sigma \text{ (diff.)} = \sqrt{av}$$

Dividing, then, the difference of the actual averages themselves (D) by σ (diff.), the amount of the difference, there is between zero and the mean in σ terms $\frac{D}{\sigma \text{ (diff)}}$ (See Chart 1.)

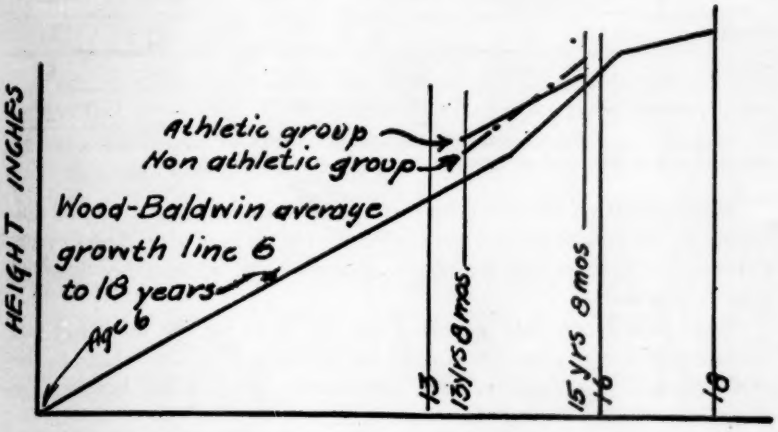
CHART NO. 1



So far as height is concerned, the average gain being 3.06″ for non-athletes and 1.27″ for athletes, our statistical procedure tells us that 64

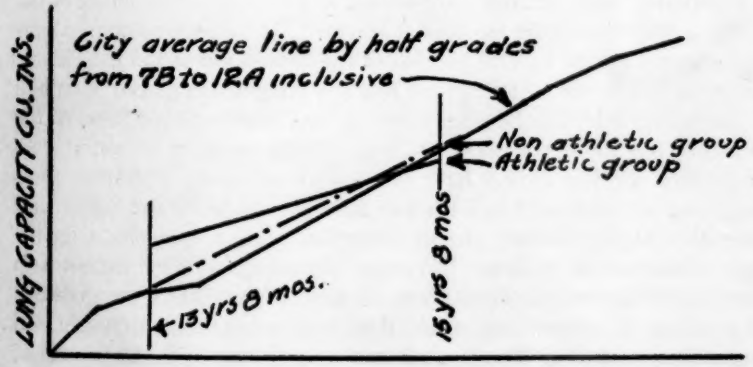
times out of 100, the boys in non-athletic group will be found to grow more in height than will the boys in the athletic group. (See Chart 2.)

CHART NO. 2



So far as lung capacity is concerned, it is discovered again by our statistical procedure that there is an absolute certainty boys not participating in athletics will gain more than will those taking part. All of these figures are, even in spite of the small number of boys observed, startlingly thought provoking. (See Chart 3.)

CHART NO. 3


LUNG CAPACITY CU. INS.
City average line by half grades from 7B to 12A inclusive
Non athletic group
Athletic group
13 yrs 8 mos.
15 yrs 8 mos

The above charts are not accurately to scale. They illustrate the findings correctly however.

The differences of the averages together with the $\frac{D}{\sigma \text{ (diff.)}}$ are herewith tabulated:

	Avg. Gain Non-Ath.	Avg. Gain Athlete	$\frac{D}{\text{Diff. Avg.}}$	$\frac{D}{\sigma \text{ diff.}}$	Chances*
Weight	18.7	17.65	1.05	1.05	85
Height	3.06	1.3	1.76	1.32	64
Lung Capacity	47	20	27	12.7	Certainty

*Figures in this column represent the number of times in one hundred chances that the true difference is greater than zero and favors the non-athletic group.

A consideration of these data then seems to indicate a substantial difference in the growth rate of boys in junior high school according to year. Further, the growth rate for height appears to be appreciably different from that of weight.

Boas points out that growth rates for boys of the same age but noticeably different sizes are sure to be different. The non-athlete in the group studied is 1″ shorter than the athlete, but 3.6 lbs. heavier, age constant.

	Non-Athlete	*Athlete*
Height	62.6	63.7
Weight	116	112.4

These differences do not seem sufficiently large to affect the results of the study.

AFTER the validity of all the data presented has been carefully considered, there remains the question or problem as to whether or not anything of a vital nature has been discovered. The groups compared have been selected by the natural process of the inclination of the individual; that is, no boy in the athletic group had any compulsion placed upon him to take part in athletics. In other words, he had a desire to compete. At the same time, no boy in the non-athletic group was required to refrain from competition. He just did not have the desire to compete. Therefore, these two groups are separated by a marked difference of desire and are natural and rather highly selected groups (selection being contingent upon the single characteristic of desire to compete in athletics). One cannot help but ask the following questions. Were the boys in the athletic group denied the privilege of competition, would they have gained more in height and weight than they did? The second question, of course, is the reverse of this: were the boys in the non-athletic group required to compete in athletics, would their growth have been any the less?

There appears to be little or no possibility of securing data directly which would even tend to suggest answers to these two questions. Those of us who have had experience in coaching athletic teams have many times

attempted to interest large, strong, healthy boys in athletic competition, only to discover that the competitive spirit was entirely lacking and, therefore, expected performance was not obtained.

All of us are entirely familiar with the fact that two boys or men of exactly the same size and weight to the pound and inch, are not necessarily evenly matched in any competitive enterprise.

Dr. T. Wingate Todd of the Brush Foundation, Western Reserve University, suggests a solution to the problem which is at least worthy of considerable thought. Dr. Todd's suggestion is that boys of athletic temperament mature earlier than do boys of non-athletic temperament, and that therefore, since the athletic group is composed of boys who have matured earlier, age considered, than the group of non-athletic boys, the athletic boy is not going to grow as much as the non-athletic boy over the period studied. In other words, the curve of average growth either of weight or height for athletic boys would be found to lie above and to have a more pronounced slope than that of the non-athletic boys through the earlier years—say, from ten to twelve or even fourteen years of age. After this point, of course, the slope of the curve of the growth for the athletic group would naturally fall off, and therefore be found to have a less pronounced slope than that for the non-athletic group.

There remains then the outstanding job of determining not only the rate of growth of two groups during the period of athletic competition but the rate of growth of two groups prior to athletic competition.

A study to determine the truth or falsity of Dr. Todd's suggestion would cover a five- to eight-year period, but it seems to be well worth the time and effort spent since certainly no one wishes to condemn interschool athletic competition on incomplete data with so large a possibility that after all, the data, while telling the truth over the period named, is but a half-truth which is at all times most dangerous and damaging.

Boas points out that the period of maximum average growth is fourteen years and six months—eleven months—or from thirteen years and five months to fifteen years and seven months or corresponding to the junior high school age. Therefore, if the physical education program is important anywhere as affecting growth, it is most important in the junior high school years.

IN CONCLUSION, more problems are thrown in just to complicate the situation further.

If the growth increments in weight, height, and lung capacity are effected by competition in athletics as indicated in the studies reported:

(a) Who knows but that the growth or development of the *mind* may also be affected?

(b) Is it the nervous strain of athletics or the excessive expenditure of energy which causes the difference?

(c) Can it be determined by controlling experiment?

(d) What part does maturity take in athletics?

(e) Do the more mature boys only compete?

(f) Is there a permanent loss for the boy in athletics, or does he have a period of accelerated growth compensating for the loss during the athletic season?

(g) Does the boy of rapid growth during his fourteenth year become the athlete?

(h) Would it be better to have physical education five periods per week for certain age groups and excuse older or younger boys entirely?

These are but a few of the problems suggested. Many others of greater importance have suggested themselves to you.

Résumé of the Physical Education Activity Program in Colleges for Women

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CHAPTER I. INTRODUCTION

NATURE AND PURPOSE OF INVESTIGATION

THE PRESENT study is in the field of curriculum, and is, in form, a survey.* The aim of the investigation is to learn the specific activities offered in the physical education activity program in colleges for women. Information on several definite points in regard to the program is sought. These points are:

1. The range of activities taught.

2. The importance, or emphasis, attached to any one or more of these in the entire program.

3. The method of organizing the classes. This refers to the three usual types of organization: (1) the entire program prescribed, the student having no choice; (2) the entire program elective; and (3) the combined program which prescribes one or more activities for all students, and allows the student to choose the remainder.

4. The culmination of the instructional program. The extent of a formal culmination to instruction in the activity, and the forms assumed in the specific activities are investigated.

The Trend of the Activity Program.—Physical education has ever been a subject in which some one type of activity dominates the field for varying lengths of time. This study may furnish some indication of a trend towards a general form of physical activity in the colleges for women.

The activities in the physical education classes may be influenced by several factors. The three listed here may be considered among the important ones, and will be studied in some detail:

1. The size of the college as determined by the number of students enrolled.

2. The geographical location of the college.

3. The organization of the teaching program.

*Summary of a graduate thesis presented at the University of Southern California.

IMPORTANCE OF THE PROBLEM

The college for women is a distinct educational unit. It is privately endowed, supported, controlled, and chartered. The policies and the financial support do not depend on the whim of the state legislative bodies and the condition of the state treasury. The curriculum is determined by the college itself, except in instances of specific endowments for a definite department or purpose.

There has been a dearth of information about the physical education program in the college for women. The first real collection is shown in *The History of Physical Education in Colleges for Women.*[1] Information about this department in women's colleges has been scarce and hard to find. When located, it usually has dealt with the five or six well known and prominent colleges, longest established. A body of information dealing with the physical education activities of all of these colleges may be of equal value to some members of the profession.

Value to New Teachers in the College for Women.—In going into a new and different situation, it is helpful to have some means of familiarizing oneself with what is done there and what is possible in like situations.

Help to Present Heads of Departments.—A department which finds itself at some variance from the other colleges of its type, or which is rendering a limited service, will have some indication of what is done in other situations.

Teacher-Training Colleges Desiring to Give a Comprehensive Program.—Any institution giving professional courses in physical education should be aware of the possible activities the students will need in their teaching positions. These students go into a wide variety of educational institutions and will be prepared to teach best those activities they have learned.

SCOPE OF THE INVESTIGATION

The college for women is the only form of educational unit studied here. Only the four-year, fully accredited institutions are included.

Activties Taught in the Required Courses.—Only those activities taught in the classes which satisfy the college physical education requirement for graduation are to be considered.

The Organization of the Program of Instruction.—The plan of organization of the classes is studied as it affects the range of activities taught.

The Culmination of the Instruction Program.—A tournament or meet in an activity which is the practical application of all that has been learned sometimes climaxes the instruction. One of the purposes of the

[1] Dorothy S. Ainsworth. *The History of Physical Education in Colleges for Women,* 116 p. New York: A. S. Barnes & Company, 1930.

study is to learn how widespread this practice is, and if it occurs in the regular class time or time outside the class. The form of the culmination is also investigated.

The Percentage of Time Devoted to Each Activity.—The actual number of days each activity is taught in a school semester or year is taken in relation to the total possible days in the same school semester or year.

The study is not concerned with the number of minutes used in instruction for an individual class, but with the number of times a class meets for instruction in a given semester, term, quarter, or year.

Points Not Included in This Investigation.—The following subjects or aspects are not touched upon in the study: physical and medical examinations; health education program; aims and objectives of program; the athletic association activities; and equipment and staff.

METHOD OF PROCEDURE

Historical Study of the College for Women.—The origin, growth, and development of these institutions is outlined in brief. The history of the physical education activities in general, and more specifically in some groups, is related. The influence of the leaders in the colleges, and the present existence of some of the early ideas as found today will be presented.

Formulation of List of Colleges and Classification of These.—Publications of the American Council on Education furnished a complete list of all colleges and universities in the United States.[2] This is used to supplement other works of a similar nature.[3] There are seventy-eight colleges for women which are fully accredited by national, regional, and state agencies.[4]

The colleges are classified into "small," "medium," and "large" according to the student enrollment. Those with less than five hundred students are "small"; those having more than five hundred and less than one thousand students are "medium"; while those with over one thousand students are "large."

They are divided geographically into the New England, the Middle Atlantic, the Central, the Southern, and the Western sections.

Formulation of List of Activities to be Checked.—Five general groups or heads were determined upon. These are: aquatics, gymnastics, individual sports, rhythmics, and team sports. The specific activities under each general group were decided upon by a study of the literature and a preliminary random sampling of twenty-five catalogues of the

[2] David Allan Robertson, Editor. *American Universities and Colleges,* 884 p. New York: Charles Scribner's Sons, 1928.

[3] Rita S. Halle, *Which College?* 305 p. New York: The Macmillan Company, Revised edition, 1930.

[4] Of seventy-eight questionnaires sent out, sixty-one usable replies were received giving a percentage of return of 78.

colleges studied. The final group came from the checking list on the questionnaire blank sent out to the directors of physical education of the seventy-eight colleges. The information asked for on these blanks included the following points:

1. General information. The extent of the physical education requirement in years; the length of time in the school year; the amount of time lost to the teaching programs by holidays in the school year; and the time utilized by physical examinations.

2. The organization of the instructional program; the restrictions on free election of activities in those programs allowing for some choice by the student; and the inclusion or exclusion of a swimming requirement for graduation.

3. The range of activities taught in classes. The amount of time each activity is taught in weeks in a semester or term; whether it is a required activity, or one which may be elected; and the culmination of the instruction in that activity.

Information secured from these blanks is presented in the form of raw data, in numerical and percentage forms in tables and charts.

Utilization of Questionnaire Information.—The length of time in the school year is computed for each college by the number of semesters (terms or quarters) in a year, weeks in that semester (term or quarter), and the number of teaching days in the week.

Each of the colleges has holidays and recesses of varying number and duration which cut unavoidably into the teaching time. Physical examinations often consume part of this time at the beginning and end of the school year, and sometimes at the beginning of the second term.

Because of these varying amounts of time, each director was asked to give the length of time of all the holidays, recesses, and physical examinations (indicating whether they delay or interrupt the activity program). This amount of time lost to instruction was totaled and subtracted from the total number of school days for that college. This gave the total number of school days available for teaching. The total number of school days was added for all the colleges contributing and a numerical average obtained. This is a constant figure for determining percentages of emphasis for any one activity in the composite program of the colleges, and is hereafter termed the "average total number of days available."

In the range of activities, each director indicated the activities taught in the prescribed program, and in the elective. The number of times an activity is taught in a week, and the number of weeks taught in a semester (term or quarter) were asked for. This gave the number of days, or the amount of time an activity occupies in the semester. Except in the case of a definitely seasonal activity (or where it was indicated as being offered in one semester only) the resultant number of days in the semes-

ter was multiplied by the number of semesters in the school year. This figure for each activity was added for all the colleges offering it, and again a numerical average obtained. This is termed the "average number of days of *tennis*" (tennis is used as an example of a specific activity).

To secure the amount of emphasis this activity has in the entire program, it is necessary to get the percentage of "average number of days of *tennis*" to the "average total number of days available."

In the chapters devoted to each of the general groups of activities, the procedure is slightly different. Here, the average total time devoted to aquatics (for example) is computed, and used with the "average number of days of swimming" to get the relative importance of swimming in the aquatic program. The same procedure holds true of diving, boating, and life-saving in the aquatic program. The specific activities under each of the general groups is treated in a like manner, and the results appear in tables and charts.

CHAPTER II. RELATED INVESTIGATIONS (Omitted in this Résumé)

CHAPTER III. THE COLLEGE FOR WOMEN HISTORICAL RÉSUMÉ (Omitted)

CHAPTER IV. HISTORY OF THE PHYSICAL EDUCATION PROGRAM (Omitted)

CHAPTER V. PRESENT STATUS OF THE PHYSICAL EDUCATION ACTIVITY PROGRAM

SUMMARY

1. Range of Activities.—These include activities in all of the general groups. They vary from the low organized, individual, almost purely social activities to the most highly organized team sports. The gymnastic, aquatic, and rhythmic activities are well represented.

2. General Activities in All Colleges.—Individual sports are the most important here, followed by gymnastics, rhythmics, team sports, and aquatics in that order. In the distributions according to size and geographical location, individual and team sports continue to be important. Aquatics, and occasionally rhythmics take an equal position with the first two.

3. Organization of the Program.—The majority of the colleges have a three- or four-year requirement for graduation. A combined program is most generally used. A purely elective, or an all prescribed program is found in a small number.

4. Culmination of the Program.—A majority of the colleges, fifty-seven, conclude the instruction with some form of the activity as a whole. Thirty-one per cent of the number reporting a culmination of any kind hold it in class time.

CHAPTER VI. RANGE OF SPECIFIC ACTIVITIES

SUMMARY

1. Number of Activities.—Eighty-seven activities are found in the entire group of colleges. Of this number forty-one were added to the original list. Of those on the list sent out to be checked, four do not appear in any of the colleges replying.

2. Size of School.—Swimming, archery, individual gymnastics, tennis, character and folk dancing, baseball, basketball, and field hockey

TABLE XVII

EMPHASIS ON ACTIVITIES COMMON TO ALL PROGRAMS

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in program	Rank as to per cent of time
Tennis	55	1	41.18	24.74	6
Basketball	54	2	30.70	18.90	20
Archery	52	3	35.72	21.38	13
Field hockey	51	4	28.07	17.28	23
Baseball	50	5.5	32.42	19.96	15
Swimming	50	5.5	46.58	28.07	3
Character dancing	48	7	48.45	29.21	2
Volleyball	45	8	31.48	19.39	18
Life-saving	42	9	35.97	21.54	12
Folk dancing	39	10	37.82	22.61	9
Individual gymnatics	33	11	52.78	32.44	1
Golf	31	12	40.90	24.57	7
Track and field	27	13	30.81	18.97	19
Diving	26	14.5	46.30	27.90	4
Soccer	26	14.5	29.69	18.28	21
Danish gymnastics	25	16	39.64	23.80	8
Tumbling	24	17	32.00	19.71	16
Deck tennis	21	18	29.04	17.88	22
Stunts	20	19	31.60	19.46	17
Hiking	18	20	26.66	16.42	24
Pyramids	13	21	34.27	20.49	14
Speedball	11	22	37.36	22.33	11
Apparatus	9	23	27.77	22.58	10
Fieldball	7	24.5	45.43	27.36	5
Natural gymnastics	7	24.5	25.71	15.83	25

The "average total number of days available" used in computing the percentage of time is 162.

This table should be read as follows: Tennis is taught in 55 of the colleges, ranking first in frequency of occurrence. It is taught an average of 41.18 days in the year, which is 24.74 per cent of the average total teaching time available, and ranks 6 in amount of emphasis on this list of activities.

are found in all of the size groups in the majority of the colleges. The small colleges alone also emphasize tumbling. The medium colleges add riding and volleyball to the above list; the large college lists in addition boating and natural dancing.

3. Geographical Location.—Archery, tennis, and character dancing are common to all sections except the South. Of this group, they present tennis only. The New England section also adds Danish and individual gymnastics, riding, and natural dancing. The Middle Atlantic emphasizes swimming and life-saving, field hockey, basketball, and volleyball. The Central section presents swimming, baseball, basketball, field hockey and volleyball together with the group mentioned above (of archery, tennis, and character dancing). The South leans to swimming, folk dancing, baseball, and basketball. The West has a longer list, made up of stunts, deck tennis, fencing, golf, riding, folk and natural dancing, and the team sports of baseball, basketball, field hockey, and volleyball.

4. Organization of Program.—The prescribed program stresses swimming, folk dancing, baseball, and volleyball. The elective programs emphasize swimming and life-saving, archery, tennis, character dancing, and basketball. The combined programs also emphasize swimming and life-saving, tennis, archery, and riding; character, folk, and natural dancing; and basketball and field hockey.

5. Placement of Activities.—The first ten activities in the "core curriculum" in regard to percentage of time are: individual gymnastics, character dancing, swimming, diving, fieldball, tennis, golf, Danish gymnastics, folk dancing, and apparatus. The first ten according to frequency of mention are: tennis, basketball, archery, field hockey, baseball, swimming, character dancing, volleyball, life-saving, and folk dancing.

Four of these are common to both lists: character dancing, tennis, swimming, and folk dancing.

CHAPTER VII. AQUATIC ACTIVITIES

SUMMARY

1. Swimming is found in more of the colleges than any of the other aquatic forms. There is a high agreement of practice and expert opinion regarding aquatic activities in the colleges for women. Fifty colleges offer swimming, while forty-two give life-saving, twenty-six diving, and fifteen boating. The distribution is about the same regardless of size or geographical location. There are one or two minor deviations, but the general picture is the same. Swimming receives major emphasis in amount of time devoted to it in the program, as well as in number of colleges offering. Diving is second in percentage of time in the aquatic program, boating is third, and life-saving is fourth and last, although it is given in forty-two schools.

2. A swimming requirement for graduation is found in twenty-eight colleges, or 44 per cent of those replying. It assumes different forms, and failure to pass does not withhold the degree at some institutions. Expert opinion on the value of a swimming requirement is well borne out by present practice.

3. The culmination of instruction is found in a variety of forms, ranging from informal demonstrations to certificates, tests, and dramatic pageantry.

TABLE XXII

AQUATIC ACTIVITIES OFFERED BY ALL COLLEGES

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in aquatic program	Rank as to per cent of time
Swimming	50	1	46.58	27.86	1
Life-Saving	42	2	35.97	21.51	4
Diving	26	3	46.30	27.69	2
Boating (crew and canoeing)	15	4	38.33	22.92	3
*Others:**					
Water polo	1				
Swimming test	1				
Stunts	1				
Games	1				
Advanced swimming	1				
Class team swimming	1				

*These additional activities are not considered in estimating the emphasis on any activity in the program.

This table should be read as follows: Swimming is offered in 50 colleges giving it a rank of 1 in frequency of occurrence. It is taught an average of 46.58 days in these colleges, and is 27.86 per cent of the aquatic program. It also ranks first in per cent of time devoted to it in the aquatic program.

CHAPTER VIII. GYMNASTIC ACTIVITIES

SUMMARY

1. Despite the varying statements about gymnastic activities, this group of colleges shows a fairly wide range in type and a trend toward two or three specific forms. Individual gymnastics leads in number of colleges offering it, with thirty-three out of the sixty-one replying. Danish with twenty-five and tumbling with twenty-four are next, with stunts in twenty colleges.

2. In amount of time spent on the activities, a combination of several forms leads, with individual, Danish, and apparatus following. Swedish is next, then pyramids, tumbling, mimetics, stunts, natural, tactics, and German.

3. Meets, demonstrations, self-testing, charts, and other tests are the forms of climax used.

TABLE XXV

GYMNASTIC ACTIVITIES OFFERED IN ALL COLLEGES

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in gymnastic program	Rank as to per cent of time
Individual	33	1	52.78	12.41	2
Danish	25	2	39.64	9.32	3
Tumbling	24	3	32.00	7.52	7.5
Stunts	20	4	31.60	7.40	9
Pyramids	13	5	34.27	8.06	6
Combination	12	6	61.66	14.50	1
Apparatus	9	7	37.77	8.88	4
Natural	7	8	25.71	6.04	10
Tactics	5	9	21.60	5.08	11
Swedish	2	10	36.00	8.46	5
Mimetics	1	11.5	32.00	7.52	7.5
German	1	11.5	20.00	4.72	12
*Others:**					
Fundamental body mechanics	2				
Advanced gymnastics	1				
Gymnastic games	1				
Indian clubs	1				
English	1				
Orientation	1				

*These additional activities are not considered in estimating the emphasis on any activity in the program.

This table should be read as follows: Individual gymnastics is offered in 33 of the colleges, ranking 1 in that regard. It is taught an average of 52.78 days in the year and occupies 12.41 per cent of the gymnastic program, ranking second in amount of time taught.

CHAPTER IX. INDIVIDUAL SPORTS

SUMMARY

1. In the small colleges, archery, tennis, golf, track and field, riding, and hiking appear most often. In the medium college the order is different, being tennis, archery, riding, and golf. In the larger institutions, tennis, archery, riding, deck tennis, golf, and track and field are mentioned most. Paddle tennis and shuffleboard are found four times; croquet, dart games, and tetherball three each.

2. According to geographical distribution, archery and tennis are constants. Riding is in a prominent place in all the sections except the Central.

3. In the amount of time the activities are taught, handball leads, although found in only three colleges. Riding, badminton, tennis, golf, fencing, bowling, archery, quoits (and horseshoes), and track and field make up the first ten in importance.

4. A variety of forms of culmination are used, varying according to the activity.

TABLE XXVIII

INDIVIDUAL SPORTS OFFERED IN ALL COLLEGES

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in the individual sports program	Rank as to per cent of time
Tennis	55	1	41.18	7.40	4
Archery	52	2	35.72	6.42	8
Riding	34	3	42.26	7.59	2
Golf	31	4	40.90	7.35	5
Track and field	27	5	30.81	5.53	10
Deck tennis	21	6	29.04	5.21	12
Hiking	18	7	26.66	4.79	13
Fencing	14	8	37.71	6.77	6
Badminton	11	9	41.27	7.41	3
Bowling	10	10.5	35.80	6.43	7
Quoits (and horseshoes)	10	10.5	33.20	5.96	9
Skiing	4	12.5	17.75	3.19	15.5
Snowshoeing	4	12.5	17.75	3.19	15.5
Handball	3	15	51.33	9.22	1
Squash	3	15	30.66	5.51	11
Skating (ice)	3	15	18.33	3.29	14
*Others:**					
Greek Games Athletics	1				
Paddle tennis	4				
Shuffleboard	4				
Table tennis	2				
Clock golf	1				
Obstacle golf	1				
Dart archery	1				
Bull board	2				
Croquet	3				
Dart games	4				
Tetherball	3				
Ping-pong	2				
Bean bag toss	1				
Walking	1				
Campaego	1				

*These additional activities are not considered in estimating the emphasis of any one activity in the program.

This table should be read as follows: Tennis is offered by 55 colleges, with a rank of 1 in that respect. It is taught an average of 41.18 days in the year, 7.40 per cent of the individual sports program, and ranks fourth in amount of time.

CHAPTER X. RHYTHMICAL ACTIVITIES

SUMMARY

1. According to size of school, the same three activities receive most emphasis. These are character, folk, and natural dancing.

2. In the New England, Middle Atlantic, and Western sections, character and natural dancing are emphasized. In the Central section, character dancing stands out practically alone. In the Southern section folk dancing is the most important, but character, interpretative, and natural are offered by a smaller number.

3. The forms of program culmination are more varied than of any other form yet studied.

TABLE XXXI

RHYTHMIC ACTIVITIES OFFERED IN ALL COLLEGES

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in rhythmic program	Rank as to per cent of time
Character	48	1	48.45	17.02	2
Folk	39	2	37.82	13.28	5
Natural	34	3	49.70	17.46	1
Interpretative	16	4	44.38	15.58	4
Gymnastic and Athletic	8	5	25.50	8.95	7
Aesthetic	5	6.5	44.40	15.59	3
Classic	5	6.5	34.40	12.08	6
*Others:**					
Combination	2				
Creative	1				
Rhythmic fundamentals	1				
Fundamentals of movement	1				
Rhythms	1				

*These additional activities are not considered in estimating the emphasis of any one activity in the program.

This table should be read as follows: Character dancing is offered in 48 colleges, ranking 1 in that respect. It is taught an average of 48.45 days in the year, 17.02 per cent of the rhythmic program, and ranks second in time used.

CHAPTER XI. TEAM SPORTS

SUMMARY

1. In the various size groups, baseball, basketball, field hockey, and volleyball all take the emphasis in number of colleges offering.

2. In the New England section, field hockey is offered more often. Baseball and basketball follow closely. In the Middle Atlantic, field hockey and basketball lead. In the Central, baseball and basketball lead, with field hockey and volleyball next. In the South, baseball and basketball are prominent, with field hockey, soccer, and volleyball next. In the West, baseball and basketball are first with volleyball following. Field hockey is next.

3. Two activities offered by a comparatively small number of colleges receive the greatest emphasis in percentage of time in the program. They are fieldball and speedball. Baseball, volleyball, basketball, soccer, field hockey, and lacrosse follow in that order.

CHAPTER XII. CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The investigation was planned to determine four points regarding the physical education activities. They are:

1. The range of activities taught.
2. The importance of any one of these in the entire program.

TABLE XXXIV

TEAM SPORTS OFFERED IN ALL COLLEGES

Activities	Number of colleges offering	Rank of activity according to number of colleges	Average number of days taught	Per cent of time in team sports program	Rank as to per cent of time
Basketball	54	1	30.70	12.00	5
Field hockey	51	2	28.07	10.95	7
Baseball	50	3	32.42	12.65	3
Volleyball	45	4	31.48	12.30	4
Soccer	26	5	29.69	11.59	6
Speedball	11	6.5	37.36	14.58	2
Lacrosse	11	6.5	21.00	8.19	8
Fieldball	7	8	45.43	17.73	1
*Others:**					
Outdoor games	3				
Adapted indoor games	1				
Giant volleyball	1				
Tenniquoit (mass)	1				
Newcomb	2				
Ice hockey	1				
Fistball	1				

*These additional activities are not considered in estimating the emphasis of any one activity in the program.

This table should be read as follows: Basketball is offered in 54 of the colleges, ranking 1 in that respect. It is taught an average of 30.70 days in the year, which is 12 per cent of the team sport program, giving it a rank of fifth in time used.

3. The organization of the program.

4. The culmination of the program.

The following conclusions are reached in regard to the above four points.

1. *The range of activities taught is wide.* Eighty-seven separate ones are found in the combined programs. The greatest number of these are of the individual sports. Gymnastics is well represented in number of activities, while team sports, rhythmics, and aquatics have smaller numbers.

There is also much variation between the activities. They vary from the loosely organized, almost parlor-type game to the team sports and life-saving where highly technical skills and coordinations are involved.

2. *The most important activities in the various programs are, in order:* individual gymnastics, character dancing, swimming, diving, fieldball, tennis, golf, Danish gymnastics, folk dancing, and apparatus.

The major premise of the investigation was the importance of, or emphasis on, activities shown by the amount of time these activities were taught (in terms of days) in the school year, in relation to the number of teaching days available. The entire list was not used in determining the emphasis, but a smaller group of twenty-five activities which were common to the three forms of organization of the program.

3. *The organization of the program is definitely toward a combined form.* This form prescribes one or more activities and allows the student

to elect the remainder. The purely elective program and the prescribed program are found in a relatively small number of colleges. This is in accordance with the literature reviewed. The college physical education requirement for graduation in these schools tends towards three and four years. Sixty-four per cent require three or more years of the students.

4. *The culmination of the program in the various activities is widespread and general.* All but four of the colleges report some form of tournament, meet, test, etc. This takes place in the regular class time in nearly one-third of the group, in time outside of class in a larger number, while a few departments utilize time in class and outside as well.

Out of these four points several questions arose. These have helped to keep the divisions in mind, and are:

(a.) Are the activities taught influenced by the size of the college?

(b.) Are the activities affected by the geographical location of the college, or by the climate?

(c.) Does the form of the organization of the program affect the activities taught?

(d.) Is there a major trend toward some general activity, or toward some one or more specific ones?

(e.) Is the program typical of the college for women, or is it similar to that in other institutions of collegiate rank?

Answers have been found, in general, to the questions asked. They do not conform to the expectations of the writer, but they are answered.

(a.) *The activities taught are not influenced by the size of the college, as shown by the data presented.* There are minor variations and exceptions to this, of course.

(b.) *Neither has the geographical location of the college much effect on the activities.* An activity will be found in one section alone, or in two adjoining ones. An example of this is lacrosse in New England and the Middle Atlantic sections; squash in the Middle Atlantic alone; and an emphasis on folk dancing in the South. New England, the Middle Atlantic, and the Southern sections cling to gymnastic forms more than the other two divisions. Danish gymnastics is popular. *Climatic conditions apparently have no influence, except in the matter of the winter sports.* These are found only in the New England and the Middle Atlantic sections.

(c.) *The form of organization affects the number of activities, but apparently not the content.* The colleges with a prescribed program have a smaller number of activities; those with a purely elective organization have a larger list; and those offering a combined plan have the greatest number. The prescribed program was found only in the small colleges, the elective was spread out more, but only a few colleges use these forms of organization.

(d.) *Team sports, individual sports, and rhythmics are found most frequently.* In the specific activities, tennis, basketball, archery, field hockey, baseball, swimming, character dancing, volleyball, life-saving, and folk dancing are offered in the greater number of the colleges.

(e.) *The program is not typical of the college for women alone.* Comparing the ten activities with the greatest emphasis in this study with a similar group found in fifteen state universities, seven appear on both lists. In the program in the state universities, the emphasis is determined according to the number of academic quarters an activity is offered.

The tendency in organization is also similar. The majority of both types of schools favor the combined program. There is a decided difference in the physical education requirement in years, however. Seven per cent of the state university departments require over two years of physical education, while 64 per cent of the colleges for women have at least a three-year requirement.

CONTRIBUTION

This study makes material available on a larger scale than was to be found previously. The one study similar to this is an historical work, dealing with twelve colleges, carefully selected. The larger number, unselected, in this investigation may be of help in verifying the other, in part.

The information on content, organization, culminations of program in general, and in detail, may be useful to other directors of physical education in colleges and universities. Those who feel that their departments are rendering limited service, and want to know what others are doing, may be aided.

The person unfamiliar with the college for women will have a guide, at least to show what the possibilities are in that form of college.

LIMITATIONS OF STUDY

The device used, the questionnaire, had several omissions which have proven a handicap in the study. In inquiring for the amount of time an activity was taught, the weeks in a semester, term, or quarter were asked for. After a few of the returns came in, it was evident that the number of terms, quarters, or semesters the activity was taught should have been secured also.

A second limitation was in failing to have an adequate group of restrictions on election to offer for checking. A previous sampling on this subject might have given more general forms to use. The ones sent out were decidedly inadequate, judging by the number of additional restrictions written in by the respondents.

A third limitation was in the manner of measuring the emphasis on

activities according to the amount of time offered with no way of indicating the proportionate number of colleges which made up that figure. That is, an activity taught in six or eight colleges (with an average of thirty teaching days for the activity) can overbalance another activity which is offered in forty or fifty colleges, but with a slightly smaller average number of teaching days.

RECOMMENDATIONS FOR FURTHER STUDY

Having found the present practice in terms of the number of colleges offering certain activities, and the amount of time devoted to each of these, individually and in general groups, another study is suggested.

An evaluation of these activities is the next step so that some judgment may be formed as to the value of the activities now taught, and the service rendered the students. A typical or standard program, possibly a minimum set of activities, might be established according to some of the classifications used in this study.

A similar survey of the programs in the state universities and in other colleges might bring some means of comparing the programs and activities, and of setting up a minimum list of activities.

The aims and objectives of the director in determining the content of the program would be an interesting but difficult investigation. In this, the effect of professional training on the department might be seen. The professional schools, and some of the college and university departments of physical education, tend to emphasize certain phases of the programs, and their students in turn are prone to do likewise. The effect of current literature (professional) in shaping the programs, innovations in the activity program, local traditions and those of the college itself, facilities, and staff might all have a great influence on the content. This, possibly, would be part of the evaluating program.

A definite investigation into the requirements in physical education would be pertinent now. The literature is beginning to show signs of evaluating and justifying programs and requirements. This may be a temporary phase, and it may be another forward step. The forms of the requirements, if not definite ones, and the restrictions placed upon selection shown in this study indicate that there may be a change near.

A Multiple Strength Index of General Motor Ability

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INTRODUCTION

THE PURPOSE of this study* was to determine the relationship of strength to motor ability and to formulate a "Multiple Strength Index of General Motor Ability." The solution of this problem required two sets of tests. The strength group was similar to that used by Rogers[1]† with the exception that lung capacity was omitted and the pull-up and push-up events were scored by McCloy's method.[2] A study made by McCloy,[3] not published as yet, shows vital capacity to be of no significant value as a strength factor. The following tests made up the strength battery:

1. Pull-up strength—from horizontal ladder
2. Push-up strength—using parallel bars
3. Grip strength—by use of hand dynamometer
4. Back strength—by use of back and leg dynamometer
5. Leg strength—by use of back and leg dynamometer

The other group consisted of twenty-three objective tests of general motor ability classified under the following heads:

1. Agility
2. Flexibility
3. Coordination
4. Arm and Shoulder Girdle Strength
5. Leg Strength

These tests involve primarily such fundamentals as running, jumping, leaping, climbing, throwing, etc. They are found in the appendix together with an explanation of each event. The motor ability tests were all scored on a comparable basis and the total composite score was used in determining, by means of multiple regressions, the relative contribution of each strength test and to find, if possible, various combinations of the strength group correlating high with the composite motor ability scores.

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* Paper given at the Research Section meeting of the American Physical Education Association Convention, Louisville, Kentucky, April, 1933.
† Numbers refer to bibliography at end of article.

SOURCE OF DATA

The tests were given to 275 boys in regular class periods at Central High School, Duluth, Minnesota, during the winter of 1931. The strength tests were given twice to obtain the best possible score for each boy. The motor ability tests were, however, given only once with no opportunity for practice except to become familiar with techniques where this was necessary. Capable student assistants were appointed and carefully trained in the administration of the tests. In events requiring the use of a stop watch, the timing was done by the experimenter to eliminate errors due to inexperience in timing. Age, height, and weight was recorded for each boy.

METHOD OF SCORING TESTS

In scoring the pull-ups and push-ups, use was made of a formula developed by McCloy.[2] This formula is as follows:

TS = 1.77 W plus 3.42 C — 46

Grip strength, back strength, and leg strength were taken by means of dynamometers according to the procedure recommended by Rogers.[4] The total for both right and left grips was taken as grip strength. In the other strength tests the raw score in pounds was used for each test.

The motor ability tests were scored by the following method.[5] From distributions for each event the standard deviation and mean were computed. All scores at or below minus three sigmas were given a zero score, the mean fifty points, and those at or above plus three sigmas were given a score of one hundred points. Intervening scores were obtained by graduating this range in units from one up to one hundred. All the motor ability scores were combined into one composite score which will be referred to in this paper as T.M.P. (total motor points).

ANALYSIS OF DATA

Step No. 1: Each of the various strength tests was correlated against T.M.P. These simple correlation coefficients together with means and standard deviations are to be found in the Appendix.

Step No. 2: Multiple regressions were worked out for various combinations of the strength tests against T.M.P. These multiple coefficients together with the regression coefficients will be given when each of the various combinations is taken up in turn.

Step No. 3: Using the following formula (3) $\overline{X}_0 = (\beta_1 \frac{\sigma_0}{\sigma_1})X_1 + (\beta_2 \frac{\sigma_0}{\sigma_2})X_2 + (\beta_3 \frac{\sigma_0}{\sigma_3})X_3 \ldots\ldots\ldots\ldots + C$

$C = M_0 - (\beta_1 \frac{\sigma_0}{\sigma_1})M_1 - (\beta_2 \frac{\sigma_0}{\sigma_2})M_2 - (\beta_3 \frac{\sigma_0}{\sigma_3})M_3 \ldots\ldots$ etc.,

where:

$\overline{X}_0$ = Predicted points
β = Regression coefficient
C = Constant
M = Mean
σ = Standard deviation
X = Variable

Four formulæ were derived for prediction of total points.

These four formulæ are taken up below and it will be noticed that each is applicable to a certain situation. For example, formula number 1 is for schools having back and leg dynamometers, parallel bars, etc.; formula number 2 for those having all necessary equipment except the back and leg dynamometer; formula number 3 for those lacking parallel bars or some arrangement suitable for push-ups in addition to the back and leg dynamometer but who still have a hand dynamometer (which is inexpensive); formula number 4 for those who merely have facilities for chinning or pull-ups and who also have a scale. Perhaps very few schools do not have a scale.

Formula No. 1:

The following combination of events was used:

0 = T.M.P.
1 = Weight
2 = Pull-ups
3 = Push-ups
4 = Grip Strength
5 = Back Strength
6 = Leg Strength

$R_{0.123456} = .6631$

Regression coefficients:

$\beta_1 = -.702$
$\beta_2 = .668$
$\beta_3 = .231$
$\beta_4 = .215$
$\beta_5 = .173$
$\beta_6 = .064$

Using the formula given in Step No. 3 and substituting the proper values we have the following:

$$\overline{X}_0 = (-8.5382)X_1 + (4.1231)X_2 + (1.4239)X_3 + (1.2762)X_4 + (.5221)X_5 + (.1108)X_6 + 724.59$$

This formula was used in rescoring the strength tests but for expediency it was reduced to the following:

$$\overline{X}_0 = -8X_1 + 4X_2 + 1.4X_3 + 1.2X_4 + .5X_5 + .1X_6$$

Formula No. 2:

The following combination of events was used:

0 = T.M.P.
1 = Weight
2 = Pull-ups
3 = Push-ups
4 = Grip strength

$R_{0.1234} = .644$

Regressions coefficients:

$\beta_1 = -.736$
$\beta_2 = .756$
$\beta_3 = .270$
$\beta_4 = .281$

Using the formula given in Step No. 3 and substituting the proper values we have the following:

$$\overline{X}_0 - (-8.9517)X_1 + (4.6662)X_2 + (1.6643)X_3 + (1.6680)X_4 + 771.442$$

To facilitate computation the above was reduced to the following:

$$\overline{X}_0 = -5X_1 + 3X_2 + 1X_3 + 1X_4$$

Formula No. 3:

The following combination was used:

0 = T.M.P.
1 = Weight
2 = Chins or pull-ups
3 = Grip strength

$R_{0.123} = .641$

Regression coefficients:

$\beta_1 = -.658$
$\beta_2 = .938$
$\beta_3 = .290$

Using the formula given and substituting the proper values we have the following:

$$\overline{X}_0 = -(8.003)X_1 + (5.7896)X_2 + (1.7215)X_3 + 741.124$$

To facilitate computation the above was reduced to the following:

$$\overline{X}_0 = -4X_1 + 3X_2 + 1X_3$$

Formula No. 4:

The following combination was used:

0 = T.M.P.
1 = Weight
2 = Pull-ups

$R_{0.12} = .591$

Regression coefficients:

$\beta_1 = -.731$
$\beta_2 = 1.224$

Using the formula given and substituting the proper values we have the following:

$$\overline{X}_0 = (-9.1109)X_1 + (9.2445)X_2 + 405.689$$

To facilitate computation the above was reduced to the following:

$$\overline{X}_0 = -X_1 + X_2$$

It will be noted that in each formula, two things have been done in simplifying it. (1) The constant has been omitted. This is unimportant if one is not *predicting* a specific score, such as the T.M.P. (2) The formula has been reduced to some approximation of the original, usually divided by some constant. This changes the *total*, but does not affect the relative scores. The original formulæ may be used where it is desired to compare one group using one test with another group using a different strength test.

It is interesting to note the results obtained with other combinations. Rump,[6] in a recent study to determine the "Relative Contribution of Arm, Back, and Leg Strength to the General Athletic Ability of High School Boys," concluded that chin and dip strength were very important in the determination of total strength but that practically no relation existed between general athletic ability and back and leg strength respectively when the other strength factors are held constant.

We found that, while back and leg strength do add to the picture when used in combination with the other strength factors, they do not contribute as much as the other factors.

Using all the factors, namely, weight, pull-ups, push-ups, grip, back and leg strength, we obtained the following when correlated against the criterion (T.M.P.) $R_{0\cdot 123456\cdot} = .6631$. Omitting leg strength we have $R_{0\cdot 12345} = .660$ showing that, while it does contribute something, the contribution is negligible. Omitting back strength in addition to leg strength we have $R_{0\cdot 1234} = .644$, a further reduction but as yet negligible. But when grip is also omitted we have $R_{0\cdot 123} = .617$ which makes it appear that grip does add considerable as a strength factor. Also when all the factors are used except weight we have the following $R_{0\cdot 23456} = .6199$ showing the importance of weight as a strength factor. On the other hand, when both weight and push-ups are omitted we have $R_{0\cdot 2456} = .6182$, a very small reduction which is, perhaps, accounted for in that pull-ups may contribute practically the same thing as do push-ups. It seems, therefore, that equation number 3 is the most practical of those given. It does not require a back and leg dynamometer, which is expensive, nor does it require parallel bars. Furthermore, it correlates highly with the criterion. As far as the hand dynamometer is concerned, it is very reasonable in price and many schools already have one. Boys are very anxious to know what their grip strength is and so it has additional value in motivation.

The correlation between predicted motor ability points and rescored strength total with age and weight held constant against each was worked out using equation (3) to be found in Appendix, Table 6.

The result obtained was as follows:

$R_{(0.12)\ (3.45)} = .540$ where

$0 =$ Total Motor Points	$3 =$ Total Strength
$1 =$ Age_0	$4 =$ Age_3
$2 =$ $Weight_0$	$5 =$ $Weight_3$

This would indicate that even with age and weight held constant to both T.M.P. and to strength, that there is a surprisingly high correlation between these factors. This would indicate that strength is an important factor in general motor ability.

PHYSICAL FITNESS INDEX

Using formula No. 1 to predict motor ability and using the mean scores for each variable we have the following:

$$\overline{X}_0 = -8X_1 + 4X_2 + 1.4X_3 + 1.2X_4 + .5X_5 + .1X_6$$

$M_1 = 129.37$	$M_4 = 142.30$
$M_2 = 209.48$	$M_5 = 325.57$
$M_3 = 201.50$	$M_6 = 373.11$

Substituting the above values in the regression equation we have $\overline{X}_0 = 456$, the predicted points for the average boy. Assuming that a boy of that particular age and height were to score a total of 684 points, his physical fitness index would be 150. This is obtained by dividing achieved points by predicted points and multiplying by 100 to eliminate the decimal. Likewise, the physical fitness index for any boy can be found by dividing his achieved strength total by the predicted total for an individual of his age and weight. A physical fitness index of 100 would be considered as normal or average.

Naturally a strength index such as the above to predict motor ability has its limitations in that a detailed picture of that boy is not given, that is, we do not have a profile of his motor skill and cannot, therefore, know exactly where his deficiency lies by merely looking at his raw score or his fitness index. But, for purposes of classification of pupils at the beginning of the school year and to locate the superior and extremely inferior pupils (the latter especially), it perhaps has its value. For purposes of motivation it is valuable. Boys are very anxious to know how they "rate" as compared to the others. Those of us who are engaged in physical education work in high schools realize the importance of motivation. Too often the boys regard their gym class as bitter medicine that has to be taken.

Perhaps it would be possible to pick out of the average class the few who are extremely inferior within the first week during regular class work. Such a procedure is unsatisfactory for several reasons:

1. During this time they would have had work for which they are incapable and serious harm may result.

2. By the time they are located they will have developed such a dislike for gym work that it will be a real problem to regain their interest.

3. As a rule the first week of school is one of chaos as far as physical education classes are concerned. Changes in programs are frequent during this period and many boys do not have their uniforms as yet. This would mean that possibly two weeks or more would pass by before the instructor would know who was who in his classes. Perhaps even then he would not be certain. A testing program such as that given here could be conducted the very first day of school whether the boy had his equipment or not. The time would not be wasted and the instructor would know immediately just how his pupils rate and be at a position to start right the following week.

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[5] McCloy, C. H. "A Statistical and Mathematical Method of Devising Athletic Scoring Tables," *American Physical Education Review,* Volume 26 (January, 1921), pp. 1–12.

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APPENDIX

TABLE 1

The Strength Tests

1. Chins or Pull-ups. Executed from a horizontal ladder at a height slightly higher than the boys could reach. They were instructed to pull up until chin was over upper edge of the ladder, and to return to position of complete extension of the arms. They were instructed to keep legs straight and together.

2. Push-ups. Executed from a cross-rest position on the parallel bars counted as one and each succeeding dip down to level of the bars and return counted one, etc. A yard stick was placed across the bars to secure uniformity in the distance of each dip. The boys were instructed to dip until the chin touched the yard stick.

3. Grip Strength. The right and left grip strength was determined by means of an oval hand dynamometer, and the total of both was used as grip strength. Procedure used was that advocated by Rogers.[4]

4. Back Strength. This was determined by means of a back and leg dynamometer. Procedure used was that advocated by Rogers.[4]

5. Leg Strength. Use was again made of the back and leg dynamometer according to procedure recommended by Rogers.[4]

TABLE 2

The Motor Ability Tests

(These tests are classified in Table 3)

1. Medicine Ball Throw from in Front of Shoulders. In this test the ball was pushed forward with both hands from a stand position. The throw was for distance forward. Weight of ball was ten pounds.

2. Medicine Ball Throw from Stride Position. The ball was grasped by hands and held between legs and as far back as possible. The throw was upward and forward for distance forward.

3. Underhand Throw for Height with Medicine Ball. The wall was marked off every foot interval with strips of adhesive tape. Each five-foot interval was marked with a longer strip of tape to facilitate scoring the throws. The throw was made from a point eight feet from the wall. The throw was upward on an angle toward wall. Height was taken where ball hit wall. Each boy was given extra trials in this test as in some cases the ball failed to touch wall. As a rule, fatigue was an important factor in reducing the height of the throw after the first two or three attempts.

4. Left or Right Leg Kick. Each boy was permitted to use either leg in this test. Technique was as follows: Boy was permitted to advance a maximum distance of ten feet in the execution of the kick. If he were to kick with his right leg he would swing left leg up first and then as he brought left leg downward smartly he kicks with his right leg. He executes what is known as a hitch kick. Kick was executed next to wall which was graduated every two-inch interval with strips of adhesive tape. Observer stood to one side facing wall.

5. Basketball Throw for Distance. To secure uniformity, the same ball was used for the entire group in this particular test. Boy was permitted to execute throw within eight-foot area.

6. Rope Climb. The climb was executed by use of both arms and legs. A twenty-foot rope was used and contestant was timed from the time his feet left the floor until he touched overhead beam with hand. To avoid injury, he was not timed on return to floor. About eight boys failed to get to the top and were given a zero score rating.

7. Burpee Test (15 seconds). Subjects were scored on the number of times they could do the following exercise in 15 seconds:

Starting position, attention. Knee bend rest, extend legs to front leaning rest, back to knee bend rest, and then back to position of attention. Body must be straight in front leaning rest position. At expiration of the 15 seconds each boy was given credit for ¼, ½, or ¾, depending on the position he was in at end of time limit.

TABLE 3

CLASSIFICATION OF MOTOR ABILITY TESTS

No.	Test	Agility	Flexibility	Coordination	Shoulder Girdle Strength	Leg Strength
1	Medicine Ball Throw—front of sh.			X	X	
2	Medicine Ball Throw—stride position			X	X	
3	Medicine Ball Throw—for height			X	X	
4	Leg Kick		X	X		
5	Basketball Throw for Distance			X	X	
6	Rope Climb	X			X	
7	Burpee Test	X	X	X	X	X
8	Five Standing Broad Jumps	X				X
9	Crawling Over Horizontal Ladder	X	X		X	
10	Three Frog Jumps for Distance	X	X	X	X	
11	Three Jumps on Parallel Bars	X	X	X	X	
12	Sixty-Yard Dash	X		X		X
13	Bar Snap for Distance	X	X	X	X	
14	Potato Race	X	X	X		X
15	Jumping Test	X		X		X
16	Ladder Climb	X		X		X
17	Running Around Chair	X				X
18	Climbing over Horizontal Bar	X	X		X	
19	Hop, Step, and Jump	X		X		X
20	Standing Broad Jump	X				X
21	Forward Rolls	X	X	X		X
22	Deep Knee Bends on Stall Bars	X	X		X	
23	Twenty-Five Free Throws			X	X	

8. Five Hops Forward with Feet Together, for Distance. The measurements were taken from the starting line to the nearest heel mark following last hop. No stop was permitted between hops.

9. Crawling over Horizontal Ladder Seven Feet High. The boy must swing legs over and pull himself up and over and descend to the floor on opposite side. Timing begins from moment he grasps ladder until his feet touch floor on opposite side.

10. Frog Jump (Three for Distance). This test is executed by diving forward

on hands bringing legs up between arms simultaneously. This is done three times in succession and measurement is taken from starting line to nearest heel mark following third jump.

11. Sixty-yard Dash: Due to lack of space this particular event was run off as follows. Two stools were placed forty-five feet apart and a boy was asked to sit on each stool facing out. The starting point was mid-way between the stools and the distance was two times around making a total of sixty yards. The runner was permitted to swing on arm of the boy seated on stool.

TABLE 4
STANDARD DEVIATIONS AND MEANS

	Factor	Standard Deviation	Mean
0.	Total Motor Points	231.09	1163.55
1.	Weight	19.00	129.37
2.	Chins	37.44	209.48
3.	Push-ups	37.49	201.50
4.	Grip Strength	38.93	142.30
5.	Back Strength	76.58	325.57
6.	Leg Strength	135.47	373.11

TABLE 5
CORRELATION COEFFICIENTS
(Key in Table 4)

Simple:

$r_{01} = .401$; $r_{02} = .546$; $r_{03} = .518$; $r_{04} = .561$
$r_{05} = .511$; $r_{06} = .434$; $r_{12} = .926$; $r_{13} = .937$
$r_{14} = .656$; $r_{15} = .562$; $r_{16} = .458$; $r_{23} = .969$
$r_{24} = .748$; $r_{25} = .629$; $r_{26} = .534$; $r_{34} = .729$
$r_{35} = .614$; $r_{36} = .527$; $r_{45} = .610$; $r_{46} = .503$
$r_{56} = .604$

Multiple:

$r_{0.123456} = .6631$; $r_{0.12345} = .660$; $r_{0.1234} = .644$;
$r_{0.123} = .617$; $r_{0.12} = .591$; $r_{0.23} = .579$;
$r_{0.124} = .641$; $r_{0.23456} = .6199$; $r_{0.2456} = .6182$
$r_{0.234} = .595$; $r_{0.178} = .464$ (7 = age, 8 = height)

12. Three Jumps on Parallel Bars. In this test the starting position was at attention facing bars and with hands grasping ends of bars. At the command "Go" the subject jumped to a cross-riding rest, taking three of these in succession and dismounting to floor on opposite side. He then immediately repeated this to return to starting position. Two round trips, making twelve times that he took a cross-riding position on the bars constituted the test. He was timed during the interval.

13. Snap Under Bar for Distance. In this event the subject was instructed to take a reverse grasp on bar which was placed at five feet. In the execution of the snap, the lower extremity and body is swung forward and upward at approximately a 45-degree angle, the body describing an arc. Upon landing the upper trunk is brought forward and the knees are flexed so that position is one deep knee bend, arms forward, and trunk erect. Measurement was taken from a point directly beneath bar to nearest heel mark.

14. Potato Race. Ten Indian clubs were placed out one at every five-foot inter-

val. At the command "Go," subject would run to first club, pick it up and return it to starting line and throw it into a basket placed there. He would then repeat this for each of the clubs in turn. He was timed during the interval.

15. Jumping Test. In this event a bar was placed one foot from the floor. Subject stood facing bar with feet together and at the command "Go" executed twenty-five jumps over the bar and was timed during the interval. They were not permitted to turn until feet touched the floor, that is, turning in the air so as to be in position for the return jump when feet touched the floor was not permitted. Subject was required to face bar on every jump. Jump was executed with both feet together.

TABLE 6

Equation Used in Obtaining $R_{(0.12)\,(3.45)}$ where 0 = Total Motor Points, 1 = Age, 2 = Weight, 3 = Total Strength, 4 = Age, 5 = Weight. (3)

$$r_{03} - r_{34\cdot5}r_{04}\frac{\sqrt{1-r^2_{35}}}{\sqrt{1-r^2_{45}}} - r_{05}r_{35\cdot4}\frac{\sqrt{1-r^2_{34}}}{\sqrt{1-r^2_{45}}} - r_{13}r_{01\cdot2}\frac{\sqrt{1-r^2_{02}}}{\sqrt{1-r^2_{12}}} +$$

$$r_{14}r_{01\cdot2}r_{34\cdot5}\frac{\sqrt{1-r^2_{02}}\sqrt{1-r^2_{35}}}{\sqrt{1-r^2_{12}}\sqrt{1-r^2_{45}}} + r_{15}r_{01\cdot2}r_{35\cdot4}\frac{\sqrt{1-r^2_{02}}\sqrt{1-r^2_{34}}}{\sqrt{1-r^2_{12}}\sqrt{1-r^2_{45}}} -$$

$$r_{23}r_{02\cdot1}\frac{\sqrt{1-r^2_{01}}}{\sqrt{1-r^2_{12}}} + r_{24}r_{02\cdot1}r_{34\cdot5}\frac{\sqrt{1-r^2_{01}}\sqrt{1-r^2_{35}}}{\sqrt{1-r^2_{12}}\sqrt{1-r^2_{45}}} +$$

$$R_{(0.12)\,(3.45)} = \frac{r_{25}r_{02\cdot1}r_{35\cdot4}\dfrac{\sqrt{1-r^2_{01}}\sqrt{1-r^2_{34}}}{\sqrt{1-r^2_{12}}\sqrt{1-r^2_{45}}}}{\sqrt{1-r^2_{01}}\sqrt{1-r^2_{34}}\sqrt{1-r^2_{02\cdot1}}\sqrt{1-r^2_{35\cdot4}}}$$

The above formula was used in determining the relationship existing between T.M.P. (total motor points) and rescored strength total in order to determine the true relationship between them without the influence of either age or weight on these totals. Hence, age and weight were held constant against both T.M.P. and strength total. This formula was used rather than the usual partial correlation formula because of the fact that it was highly probable that the relationship of age and of weight to total motor points and to total strength would be quite different.

16. Ladder Climb Against Time. Two round trips up and down the vertical ladder, one rung at a time, constituted this event.

17. Running Around Chair. In this event boy was timed to see the number of times he could run around a chair in twenty-five seconds. He was given credit for ¼, ½, or ¾, depending on position when time was up. A rosin pad was used to eliminate slipping.

18. Climbing over Horizontal Bar. In this event the object was to see how many times subject could swing over bar, placed at 4½ feet, in 15 seconds. If, at the end of time limit, he was over the bar, he received credit for ½ a turn.

19. Hop, Step, and Jump. A ten-foot start was permitted. The technique is as follows: In the execution of the hop, the take-off and landing is made with the same

foot. Then the step is made with the opposite foot. The jump is similar to a running broad jump. The boys were instructed to execute the hop with the leg opposite the one they ordinarily use for take-off in the running broad jump. This permitted them to obtain the maximum in the jump.

20. Standing Broad Jump. The measurement taken from starting line to nearest heel mark.

21. Number Forward Rolls in 10 Seconds. In this event subject executed two rolls on the mats and then turned around and did the same in opposite direction. If he was down on the mats at expiration of time, he was given credit for ½ a roll.

22. Deep Knee Bends on Stall Bars. The boy was timed to see how many deep knee bends he could execute in fifteen seconds. Technique was as follows: Subject faced the stall bars, placed feet on first rung, and then grasped rung on level with hips with hands. From this starting position he executed deep knee bends during the fifteen-second interval. If he was in knee bend position at expiration of time limit, he was given credit for ½.

23. Twenty-five Free Throws. All boys were required to use the same form, that is, an underhand throw with both feet up to the line. The throws were completed in two groups of ten and one of five.

The Effect of Training on the Adolescent and an Attempted Scientific Evaluation of Selected Activities

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INTRODUCTION

IT IS generally conceded by physical educators that the field of physical education needs prognostic tests of measurements which accurately predict potential organic vigor at any given time.* The field of physical education has been slow in recognizing the value of a prognostic test as a valid measurement of present functional health conditions. This type of test is particularly needed because the principle criterion for determining the fitness of one's ability has been "successful performance." It is well to know the individual's potential capacity before participation in athletic sports. It is likewise well to measure the recovery of an individual from recent illness before allowing participation in strenuous activities.

Some investigation and study of the physiological effects of exercise have been carried on† [1, 2] but experimentation is needed to determine the proper kinds and amounts of athletic activities for various age levels among individuals with varying physical capacity. There is a need for a scientific tool in the evaluation of athletic activities in order to prescribe a camp activity program with the assurance that the desirable organic changes take place, thereby avoiding excessive activity and possible physical and emotional harm to the girl.

Using the Schneider Cardiovascular Rating as a measure of fatigue and efficiency the problem attempted may be stated clearly in the form of three questions:

1. What is the effect of training on the adolescent's cardiovascular rating?

2. What is the effect of certain athletic activities upon potential organic vigor as shown in the recovery following fatigue produced by the activity?

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* Paper presented at the American Physical Education Association Convention, Research Section, Louisville, Kentucky, April, 1933. (A summary of a Master's Thesis at the University of Cincinnati, 1933).

† Numbers refer to bibliography given at end of article.

3. What effect do certain athletic activities have upon blood pressure and pulse rate?

General Method of Procedure.— The experiment was carried out at Lake Lure Camp for Girls, Lake Lure, North Carolina, with thirty-eight campers and thirteen counsellors between the ages of nine and thirty. The subjects were classified according to physiological age, and the age was determined by Crampton's test[3] into the following groups:

Group 1—Prepubescent or Immature
Group 2—Pubescent or Maturing
Group 3—Postpubescent or Mature
Group 4—Postadolescent

All the subjects experienced the control condition of diet, rest (ten hours sleep and one-hour rest period during day), recreational activity, and environmental conditions which the investigator terms as "training."[4]

Scientific Organization of Camp Activities.—The factor of interest is an important one in education, therefore a preliminary study was made to determine their choice of activities. Skill tests were then given by the counsellors, and on the basis of interest and capacity the campers were classified into activity groups. The activities offered might be classified into two types—"quiet" type such as archery, riflery, puppetry, arts and crafts, woodcraft, and dramatics; and "strenuous" type such as swimming, life saving, canoeing, tennis, hiking, natural dancing, tap dancing, horseback riding, and golf. Individual schedules were made out for each camper, allowing two hours of each type daily. This "choice" program guards against the strain of a highly organized camp. Each camper reported once daily to the hospital which was in charge of a graduate nurse.

A. EFFECT OF TRAINING ON THE ADOLESCENT

Testing Procedure.—The directions for the cardiovascular rating as given by Schneider[5] were followed at all times. The pressure of the blood in the brachial artery in the right arm was taken with a portable Tycos dial sphygmomanometer which was calibrated and found to give correct readings. The pulse stroke was taken in the radial artery by palpation and frequently checked by auscultation at the apex of the heart to make sure that no pulse deficit was present in any of the cases.

The time of day selected for giving the test was in the morning at least two hours after breakfast, thereby avoiding diurnal variation, and only when a quiet type of activity was scheduled. The tests were administered to each subject in the hospital with the able assistance of a graduate nurse at the beginning of camp and at the end of the first, fourth, and eighth week of training period. After the Schneider Test was given, the weight was recorded and the history of the case entered. A height-weight check was made according to the tables set up by Baldwin–Wood, and those

under weight were made to drink extra portions of milk. Each subject's weight record served as an incentive in keeping in training and living up to their individual health score charts.

Effect of Training.—The majority of the experiments of the physiological changes that produce and increase in fitness have been made by comparing the results of individuals in training with the results obtained from a group of non-athletes.[6, 7, 8, 9]

The comparison between the athlete and the non-athlete may not give the true results of training so this study follows the individual during a course of training over a period of eight weeks. The criticism is thereby avoided that the physiological response of the athlete to work is an inherent property of the athletic type, and the physiological differences have not been brought about by training.

Training is attributed as causative for the results shown in the following figures which portray the results of each group mean secured from the six measures composing the Schneider Test.

1. The reclining pulse rate decreased with training in each individual, and the mean rate for each group was lowered as follows: (See Fig. 1.)

Prepubescent group	— 9 beats per minute
Pubescent group	—13 beats per minute
Postpubescent group	— 9 beats per minute
Postadolescent	— 4 beats per minute.

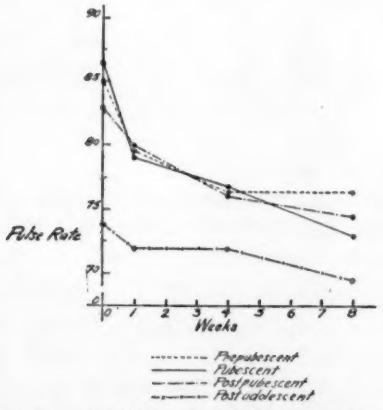

FIG. 1.—Effect of training on mean pulse rate reclining for four groups of girls.

2. The prepubescent and pubescent groups showed a higher pulse rate and greater variability than the postpubescent and postadolescent groups.

3. The standing pulse rate decreased in each individual and the mean rate of each group indicates that training likewise decreased the varia-

tion between reclining and standing positions. All groups increased less than sixteen beats which is a favorable sign of fitness according to Meylan's rating.[10] (See Fig. 2.)

4. Pulse rate after exercise is greater in the untrained than in the trained. The pulse rate increased relatively less in each of the groups over the training period which was as follows: (See Fig. 3.)

Prepubescent group	— 5 beats per minute
Pubescent group	— 3 beats per minute
Postpubescent group	—10 beats per minute
Postadolescent group	— 3 beats per minute.

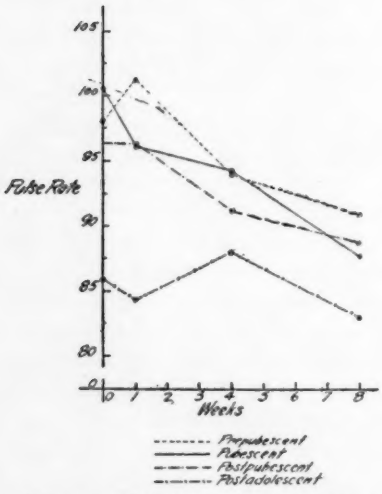

FIG. 2.—Effect of training on mean pulse rate standing for four groups of girls.

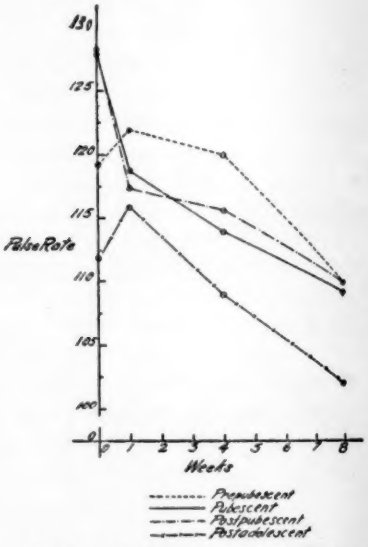

FIG. 3.—Effect of training on mean pulse rate after exercise for four groups of girls.

5. The return of pulse rate to the normal standing position after exertion was more prompt in the trained than in the untrained individual. All exceeded forty-five seconds in the return to normal at the opening of camp, and were below thirty seconds at the close of camp. The minimum time required for the return to normal standing position at the end of the period of training was twenty-one seconds in the prepubescent group and twenty-six seconds in the postpubescent group. (See Fig. 4.)

6. Systolic pressure reclining was found to be lower than in previous studies.[11, 12] The mean determinations for the four groups are as follows:

Prepubescent group	— 94 mm. Hg.
Pubescent group	— 99 mm. Hg.
Postpubescent group	—102 mm. Hg.
Postadolescent group	—105 mm. Hg.

7. Increasing physiological and chronological age results in gradual increase in systolic pressure.

8. There is an absence of any conspicuous effect of training on the systolic, diastolic, or pulse pressures in the reclining position.

9. The postural change was accompanied with a systolic drop at the beginning of the training season. As training progressed the postural change from reclining to standing position was accompanied with a rise in systolic pressure. (See Fig. 5.)

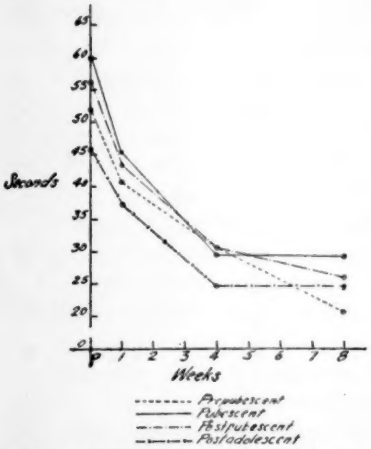

FIG. 4—Effect of training on the return of mean pulse rate to standing normal after exercise for four groups of girls.

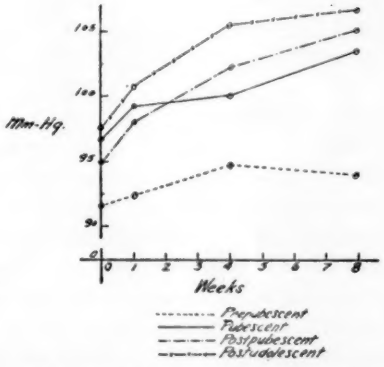

FIG. 5—Effect of training on mean systolic pressure standing for four groups of girls.

10. The diastolic pressure rose on changing from reclining to standing position at the beginning of the training period. As training progressed the diastolic pressure was not affected by the postural change.

11. An inordinate decrease in the value of pulse pressure was evident at the early part of the training period on changing postural positions. As training progressed the systolic pressure rose and the diastolic remained unchanged, thereby increasing the pulse pressure. (See Fig. 6.)

12. The Schneider Index, the sum of six measures used, according to Fig. 7, disclosed that all subjects were affected most favorably by the control condition (training), and that the effect of training was most beneficial.

13. The prepubescent curve varies from the other group curves at the end of the first week of the training period, as shown in Figs. 2, 3, and 7. This variation was attributed to too strenuous an activity program. When the instructional periods were shortened the prepubescent curve showed the same effect of the control condition as did the other group curves.

B. AN ATTEMPTED SCIENTIFIC EVALUATION OF ACTIVITIES

The problem investigated and herein reported is not an attempt to prove any given statement, but offers a technique for the procedure of using the Schneider Cardiovascular Rating as a measure of fatigue. An effort is made to determine:

1. What athletic activities temporarily lower the physical fitness index taken after a subsequent rest period, and the significance of this fact.

2. What the changes in blood pressure and pulse rate accompanying participation in certain athletic activities are at different physiological age levels.

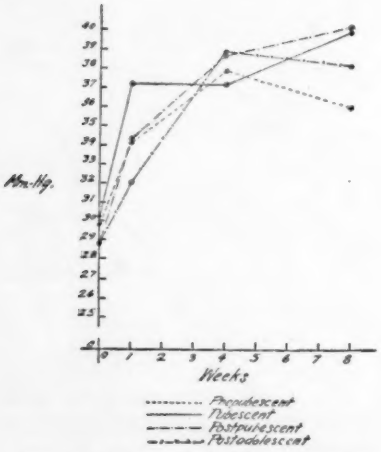

FIG. 6—Effect of training on mean pulse pressure standing for four groups of girls.

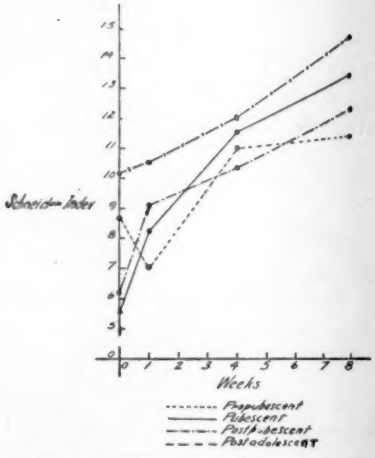

FIG. 7—Effect of training on mean Schneider Index for four groups of girls.

REVIEW OF LITERATURE

Effect of Exercise Upon Blood Pressure.— Ever since the discovery of reliable methods of determining blood pressure in man there have been numerous attempts to apply the methods to the study of the effects of exercise.[13, 14, 15] According to McCurdy[16] in exercises of strength such as weight lifting, the blood pressure rises rapidly to a great height, and falls rapidly on cessation of the effort. In exercises of speed the blood pressure rises somewhat less rapidly and returns to normal more slowly. For exercises of endurance the pressure does not rise so high as in the two preceding types, and after the exercise of endurance it often falls below normal and may not return for two to four hours.

Effect of Exercise on Pulse Rate.— It is a matter of common knowledge that the pulse rate is accelerated during exercise. McCurdy,[17] in a study of the relation of various types of exercise to pulse rate with adolescent boys, found the greatest acceleration in exercises of speed, the smallest

in exercises of strength, and that exercises of endurance increased the pulse rate more than exercises of strength, but not as much as exercises of speed.

METHOD OF PROCEDURE

The types of exercises investigated herein are of a recreational nature and involve speed and endurance. In consideration of the difficulty in measuring blood pressure during activity, and of the determinations taken immediately after the activity probably being no better indications of the hypertension developed during the activity, as blood pressure falls rapidly upon cessation of the activity, it was deemed wise to have the following procedure. At least thirty minutes were allowed to lapse between completion of the specific activity and the determination of pulse rate and blood pressure by the Schneider method. The objective was to measure the effect of the specific activity upon potential organic vigor as shown in the recovery following fatigue produced by the activity.

Since training, the nature of the activity, and its duration influence blood pressure and pulse rate changes as does the factor of individual variation, the selected activities were not measured until the end of the fourth week of the training period. An overnight hike was measured one to two hours after the return at the end of the third week. A short hike at the end of the second week was measured the following day. The data for the short hike was not compared as there was a variation of procedure. The duration of the instructional period for the pubescent and postpubescent groups was forty-five to sixty minutes in all activities. The prepubescent group instructional period was thirty to forty-five minutes; a decreased Schneider Index in the early part of the training period seemed to indicate that the endurance and resistance to fatigue in this group was not as great as those physiologically older.

An individual comparison was made between the data secured after the specific activity and the individual's most recent cardiovascular rating given under restful conditions. These findings were tabulated in comparison tables and the results of the mean difference in pulse rate and blood pressure and Schneider Activity Index are disclosed in Tables I, II, and III.

TABLE I

MEAN DIFFERENCE BETWEEN REST AND ACTIVITY PULSE RATE FOR THREE GROUPS IN THE SPECIFIC ATHLETIC ACTIVITIES

Specific Activity	Mean Difference Between Rest and Activity Pulse Rate											
	Reclining Pulse			Standing Pulse			Exercise Pulse			Return to Normal		
	P_1*	P_2*	P_3*	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
Tumblind	8.25			6.			8.			3.75		
Life Saving		5.39	6.46		7.25	10.7		6.	8.61		4.61	4.61
Natural Dancing	7.33	6.	5.78	6.44	8.	9.14	8.	4.88	7.14	10.	0.	3.21
Long Hike	10.	5.07	3.42	13.3	8.23	5.84	10.6	5.54	4.42	−5.	2.31	1.
Swimming	5.33	1.	3.07	3.66	2.61	5.53	2.22	3.36	5.53	0.	2.3	0.
Tap Dancing		2.	2.31		7.34	6.77		6.85	6.77		2.5	2.5
Riding	2.66	.77	3.43	6.	2.44	3.28	7.55	2.44	2.28	6.66	1.15	2.28
Short Hike		.09	−4.9		0.	−7.1		1.8	−3.7		−3.5	−7.4
Archery	.66	.15	.52	−4.4	.28	.66	−1.8	0.	0.	−5.1	3.42	0.

TABLE II

MEAN DIFFERENCE BETWEEN REST AND ACTIVITY SYSTOLIC AND PULSE PRESSURES FOR THREE GROUPS IN THE SPECIFIC ATHLETIC ACTIVITIES

Specific Activity	Mean Difference between Rest and Activity Arterial Pressure								
	Reclining Systolic			Standing Systolic			Standing Pulse Pressure		
	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
Tumbling	−1.			−9.25			−11.		
Life Saving		−6.4	−5.9		−8.9	−8.1		−17.6	−15.4
Long Hike	−4.	−7.2	−7.2	−4.1	−5.	−4.1	− 7.	−12.1	−14.2
Swimming	−1.6	−2.	−3.3	−6.6	−4.8	−3.3	−10.	−12.7	− 9.1
Natural Dancing	− .22	2.99	− .14	−4.2	−4.1	−5.7	−11.3	−11.3	−14.4
Short Hike		−4.2	−1.1		−5.4	−3.4		−11.1	− 6.9
Riding	− .22	.62	.78	−2.6	− .69	−1.1	− 7.4	−10.2	− 9.7
Tap Dancing		− .68	−1.2		0.	− .61		− 9.4	− 8.8
Archery	−2.4	− .1	− .4	−4.1	.21	− .33	− 4.	− 7.	− 7.1

TABLE III

COMPARISON OF MEAN REST AND MEAN ACTIVITY INDEXES FOR THREE GROUPS IN THE SPECIFIC ATHLETIC ACTIVITIES

Specific Activity	Mean Rest Index			Mean Activity Index			Mean Lowering due to Activity		
	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
Life Saving		11.59	10.92		5.77	5.07		5.62	5.85
Tumbling	11.75			6.			5.75		
Natural Dancing	11.88	12.62	12.85	7.11	8.66	7.71	4.77	4.36	5.14
Long Hike	12.07	11.	10.91	4.07	5.77	6.84	8.	5.23	4.14
Tap Dancing		13.	12.92		9.60	9.85		3.45	3.07
Swimming	10.22	11.53	11.38	6.44	8.61	8.92	3.77	2.61	2.46
Riding	11.88	12.77	12.57	8.33	10.77	10.36	3.55	2.	2.21
Short Hike		6.34	8.35		6.31	8.92		2.23	+.57
Archery	6.44	11.	10.92	7.	10.32	10.20	+.55	.69	.79

* P_1 Prepubescent
* P_2 Pubescent
* P_3 Postpubescent

An average of the means for the three groups in Tables I, II, and III obtains for certain athletic activities the following rank order:

1. Analysis of the data relative to pulse rate acceleration:

Swimming	Natural Dancing	Horseback Riding
Tumbling	Long Hike	Archery
Life Saving	Tap Dancing	Short Hike

2. Analysis of the data relative to decrease in arterial pressure:

Life Saving	Swimming	Horseback Riding
Long Hike	Natural Dancing	Tap Dancing
Tumbling	Short Hike	Archery

3. Analysis of the data relative to activity index and accompanying lowering of rest index:

Life Saving	Natural Dancing	Horseback Riding
Tumbling	Tap Dancing	Short Hike
Long Hike	Swimming	Archery

SUMMARY

1. The control condition of diet, sleep, and athletic activity has been defined as training. The effect produced by training on the circulatory

reaction in prepubescent, pubescent, postpubescent, and postadolescent groups was as follows:

a. The pulse rate decreased in the various postural positions, and the heart returned more rapidly to normal after exercise.

b. The systolic pressure rose on changing from reclining to standing position and was not accompanied by a systolic drop as in the beginning of the training period.

c. The pulse pressure was increased; before training there was an inordinate decrease in the value of the pulse pressure because of the rise in the diastolic pressure which did not obtain at the end of the training period, and the systolic drop on changing postural positions which also did not obtain.

The cardiovascular rating expressed by the Schneider Index showed a regular increase over the eight weeks of training.

2. In this investigation a temporary lowering of the Schneider Index took place after specific activity. The lowering of the mean index was not the same for each activity and varied directly with the strenuousness of the specific activity. Using the effect of the lowering of the Schneider Index as a measure of the strenuousness of the activities, the following rating is obtained in the specific situation with thirty-seven subjects with a chronological age range of nine to seventeen:

Prepubescent Group	*Pubescent Group*	*Postpubescent Group*
Overnight Hike	Life Saving	Life Saving
Tumbling	Overnight Hike	Natural Dancing
Natural Dancing	Natural Dancing	Overnight Hike
Swimming	Tap Dancing	Tap Dancing
Riding	Swimming	Swimming
Archery	Riding	Riding
	Archery	Archery

There is a difference in the ability to do certain athletic activities at different physiological age levels. For this specific situation the prepubescent group was not able to indulge in the same type of activity as long as the other groups. A greater increase in pulse rate and decrease in systolic and pulse pressures were shown in the prepubescent group than in the other two groups.

3. The specific activities measured by the Schneider Tests were exercises of speed and endurance. For the method of teaching, duration of period, and age of subjects, the findings of this study permit the investigator to classify life saving, tumbling, distance hiking, and natural dancing as activities of exhaustive endurance. The activities of moderate endurance are tap dancing, swimming, horseback riding, and archery.

The first group of activities result in a greater acceleration of pulse rate in the various postural positions, and a slower return to normal after exercise; a more pronounced subnormal reclining systolic and standing

pulse pressures, and a greater systolic drop on changing to standing position, than was revealed in the second group of activities.

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BOOK REVIEWS

VOLLEY BALL—A MAN'S GAME. Robert E. Laveaga. (A. S. Barnes & Co., 1933) 218 pages. $2.00.

Merely to be the *first* to do a thing is generally considered in America sufficiently remarkable to merit commendation and praise. When the exploit or project completed carries with it not only the element of originality but also is characterized throughout by an excellence of workmanship seldom exhibited in a pioneer effort, the author of this effort deserves the best that an interested world can give him.

Mr. Laveaga has written the first book on volleyball for men. By so doing, he has done more to elevate the game to a position of equality with such games as basketball, football, and baseball than has any other one man.

Volleyball is a game that, considered from every angle, should occupy an important place in the schools of the nation. At the present time, in most schools, it is so poorly taught that boys develop a positive dislike for it. This poor teaching has not been wholly the fault of the teacher. It has been largely due to an almost total absence of literature on the game. This book goes a long way toward remedying that situation.

It is, perhaps somewhat unfortunate for the schools that the author wrote his book from the viewpoint of a Y.M.C.A. physical director and that the development of volleyball skills in men playing in Y.M.C.A.'s should constitute its major theme. However, volleyball has been cradled in the Y.M.C.A.'s of the nation and if there is one thing we in the public schools can learn from the "Y" it is this game of volleyball. The average "Y" team of forty-year-old men usually proves vastly superior to the best college team—providing the college has a team.

It will be necessary at times for the physical education teacher to make some adjustments in his presentation of material from Mr. Laveaga's book, but this will not be difficult to do.

There are excellent chapters on how to teach the fundamental skills of volleyball. One of the finest sections of the book is the chapter headed *Defensive and Offensive Play* which presents volleyball as a game requiring just as high a type of cooperative team play as that demanded by the game of football or basketball.

I would strongly urge everyone to read this excellent book and especially should these two groups read it:

1. The physical education teacher—to awaken him to the realization of his own ignorance of a great game and to the wonderful possibilities inherent in it.

2. The volleyball player—to show him that there is still a great deal for him to learn.

The author has indeed made a splendid contribution to the literature of physical education.

H. G. DANFORD,
Director of Physical Education,
Lima, Ohio

A TEXTBOOK OF HUMAN PHYSIOLOGY FOR COLLEGE STUDENTS. August Krogh, Ph.D., L.L.D., and Katherine R. Drinker, A.B., M.D. (Lea & Febiger, 1932) 233 pages.

In the field of science, modern education is placing more and more emphasis on the importance of showing relationships which exist between various fields

of knowledge and of helping the student to discover cause and effect relationships. A study of the human organism which does not give the student some understanding of the "why" of things is comparatively meaningless and of little practical value.

This textbook of physiology, a revision of an old edition first appearing in Danish in 1908, attempts to show relationships and gives the student some understanding of some of the chemical causes of physiological functions. It is designed primarily for college students, but it would also be of value to the professional student in physical education and to the high school teacher of health, biology, or general science.

"A text book for these educational stages must be elementary, but it can be made either discursive or concise. Each system has definite advantages and disadvantages, but the writer deliberately selected a concise presentation in which every period requires careful perusal by the student. A serious endeavor has been made to keep the book abreast of the development of physiological science, but this ideal can be only imperfectly approximated and all I can hope is that the points antiquated are not too essential or numerous."

While the book contains much of the usual subject matter in physiology, the arrangement and discussion of the various topics is exceptionally concise. A logical sequence is observed throughout and inter-relationships are maintained in a delightfully simple manner. The emphasis throughout the book is placed on the chemical analysis of structure and the chemical causes of function in so far as they are known. This approach enables the student to obtain a more thorough appreciation of physiology because the nature and cause of structure and function are more clearly indicated.

The study of the human organism begins with a discussion of the chemical constituents of the body; this in answer to the question—of what are we composed? Much of the discussion is in terms of organic and inorganic compounds. How these compounds get into the body in the form of foods, how they are digested, absorbed, decomposed and utilized in the production of energy and the replacement of worn out tissues is all concisely yet briefly presented. The functions of heat regulation, excretion, and respiration are all naturally included in this discussion.

The essential food constituents for proper nutrition and body metabolism make evident again the relationship between the elements of the body itself and the nature of the fuel necessary to maintain it.

The function of the glands of internal secretion, general function and structure of the nervous and muscular systems and a fresh approach to the special senses should give to the student, carefully perusing this book, a very good idea of human physiology. After all, a first responsibility in teaching, seems to be to aid students in understanding not only how they are made and how they function but "why." It is to chemistry that we must look for more information concerning the "why." A few excerpts may help to illustrate this point:

"The compounds of which the human body is made are partly taken in with the food in their ultimate form, and are partly synthesized within the body from more simple substances. These compounds are extremely numerous, many of them being very imperfectly known chemically, but they have in common that they are all composed of a few of the chemical elements and that the greater number, even of these, occur in very small quantities only. The elements present in the human body are: carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, iodine and fluorine, and the metals, potassium, sodium, calcium, magnesium, and iron.

"These elements occur in the organism partly as inorganic, and partly as organic compounds. Among the inorganic compounds, water is preponderant, constituting about two-thirds of the total

body weight. The body contains, furthermore, a number of salts, of which some are dissolved in the body fluids, some deposited as solids."

And again, "As a result of digestive processes, food substances are dissolved in order that they may pass through the wall of the intestine; at the same time, they are decomposed into simpler substances from which the constituents of the human body may be synthesized. Digestion itself is a chemical process and takes place by means of enzymes, but it is accelerated by the mechanical treatment which food undergoes in the mouth and in the stomach."

"The human heart contracts, on an average, 60 to 80 times per minute. The frequency is larger in children—about 140 times per minute at birth—and decreases with advancing age. At each heart-beat, exactly the same amount of blood, about 50 to 70 cc., is driven out into the body and into the lungs, respectively. The pressure in the arteries of the body is 100 to 140 mm. of mercury above atmospheric pressure."

"The velocity of the blood flow is inversely proportional to the aggregate cross-section through which it is flowing. In the arteries and larger veins, the velocity is large—about 0.5 mm. per second or 1 mile per hour—but the total cross-section of the capillaries is so large that the velocity falls off to less than 0.5 mm. per second. The toal amount of blood in the body, estimated at 3 to 5 liters, makes about one circulation every minute."

These brief passages should illustrate the detail and simplicity of statement.

Eighty-three simple experiments supplement the discussions. Particular experiments to illustrate various principles are indicated in the text. In this way the book combines the happy features of a laboratory manual with those of a well written text.

It would be unfair to leave the discussion of this book without mentioning the chapter on reproduction. In seven compact pages, the elements, organs, and processes of reproduction are excellently described.

In some respects this is an unusual book. The most outstanding quality is its compactness, conciseness and apparent accuracy.

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SOCCER FOR JUNIOR AND SENIOR HIGH SCHOOLS. John Edgar Caswell. (A. S. Barnes & Co., 1933), 96 pages. $2.00.

Soccer is a team game that offers every advantage that may be attributed to football, basketball, or baseball—America's traditional games. Its progress has been hindered because many teachers of physical education have not been properly trained to recognize its advantages.

Overemphasis of the so-called "major" sports in our professional schools restricts the program in many directions. Graduates of these institutions naturally put into practice in their own programs those things that were learned during their training period.

Some important activities that have been neglected in the recent past, but are again beginning to assert themselves wholly on their merits are individual activities like apparatus and tumbling stunts and team games like soccer and volleyball.

Because of the apparent deficiency in our professional schools, this book answers a very definite need for those men who recognize the merits of soccer but have had no training in that direction. Even in the face of these handicaps, soccer is winning more players every year than any other activity with the exception of golf. The author makes the justifiable statement that "it bids fair to become the most popular and widespread game in the world."

The book portrays in a very simple style the fundamentals of the game of soccer as well as a brief sketch of the manner of playing the various positions offensively and defensively. The reviewer would not hesitate to recommend it hig-

ly to all members of the profession in general and in particular to those who desire to institute soccer in their programs.

The author includes a number of games and relays that may be used to good advantage in high school or college classes. This method of presentation tends to make the teaching of the fundamentals of kicking, passing, trapping, tackling, intercepting, or blocking very interesting and enjoyable.

The author indicates how the game may be modified to fit into a physical education program for girls.

Within the near future, it would not be amiss to find more publications on soccer that treat the game somewhat more technically than is done in Caswell's book.

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THE ADMINISTRATION OF THE SCHOOL HEALTH PROGRAM. Report of the Subcommittee on the Administration of the School Health Program, White House Conference on Child Health and Protection. (Century Company, 1932.) 41 pages. 50c.

This booklet is another addition to the increasing amount of significant and useful knowledge that the field of health education is gaining from the White House Conference on Child Health and Protection.

Fundamental principles and practices in school health administration are discussed pointedly and recommended in this report by a sub-committee of superintendents of schools, professors of education and physical education, and health administrators working in diverse localities throughout the United States. It is a practical guide for superintendents and directors of health and physical education in outlining their school health programs. No controversial issues are discussed—the committee has confined its work to a résumé of procedures and phases that should be functional parts of every school health program. The experience and influence of Dr. Thomas D. Wood are quite apparent in the recommendations of this group.

A few statements of general policies and principles will undoubtedly interest the reader. School health service, because of its educational value and administrative efficiency, should be included in the responsibility of educational authorities working in cooperation with local health authorities. All those engaged in school health service should have educational training because the nature and the purpose of the school health program are definitely and fundamentally educational. School authorities should be concerned with all measures for conserving and improving the health of school children. Schools should strive to minimize their activities in the reparative and curative fields. Remedial and corrective work with few exceptions should be left to the family; it is their fundamental privilege and responsibility. Training in parenthood in the junior and senior high school should be stressed.

The Administration of School Health Program is considered in five chapters, viz.: Terminology, General Policies and Principles, Administering the School Health Program, The Program, and Health Education. A brief but pertinent bibliography is included.

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ALCOHOL AND MAN: EFFECTS OF ALCOHOL ON MAN IN HEALTH AND DISEASE. Edited by Dr. Haven Emerson and associates. (Macmillan Company, 1932.) 451 pages. $3.50.

Dr. Emerson and his associate editors have produced a significant contribution calculated to show the way out of "the muddled thinking, emotional floundering, and political propaganda" to which the citizens of the United States have been subjected during recent months.

Practically every aspect of the alcohol question is included, and each is treated by the presentation of such a mass of

scientific data and of conclusions based thereon that only by a compilation could the work have been prepared. More than a dozen and a half scientists, specialists in their respective fields, have not only summarized findings but have listed nearly four hundred bibliographical references for those who wish more details.

In its physiological effect alcohol is recognized as a source of energy, quickly available (5 to 11 minutes), but is not a food which enters into cell structure. It cannot produce growth nor repair tissue. On the brain and nervous system alcohol in all concentrations is a depressant, so lowers skilled work and impairs judgment, and "is to be avoided wherever acuteness of perception and speed of execution are required, as for example, in driving an automobile." (Page 22.)

As a drug, alcohol of 70 per cent strength is an excellent disinfectant, killing bacteria almost immediately. In reflexes, e.g. knee jerk and lid reflex, alcohol slows the reaction time and reduces the extent. The apparent stimulating effect of alcohol is explained on the basis of its action as an "inhibition of inhibitions." For certain skin conditions, an application of alcoholic solutions shows beneficial effects, but alcohol is one of the group of drugs classed as narcotics, whose dominant action is a depression of function of all forms of living tissue (page 31). Its value as a solvent is undoubted. Some light is thrown on the amount necessary to cause intoxication. This varies with several factors such as condition of drinker, habituation to the drug, and the concentration of alcohol in the beverage used. There seems to be conclusive evidence that the degree of intoxication corresponds to the alcohol concentration of the blood. Miles is quoted as finding that after drinking one quart of 3 per cent beer the venous blood contained from 0.03 to 0.05 per cent of alcohol in about seventy-five minutes. In abstainers there were no symptoms of a slight dizziness and incoordination, but with the same amount of alcohol, viz., two ounces of whiskey, there were appreciable symptoms such as dizziness, unsteadiness, and confusion, but in habitual drinkers, no real intoxication. In the experiments, the alcohol was taken when there was little or no food in the stomach (page 59.)

Regular indulgence of even moderate amounts is found to reduce chances of longevity. Life insurance statistics are quoted as supporting this conclusion.

As a therapeutic agent, alcohol is regarded as of less value than formerly, its use by the better trained physicians has decreased greatly and is continuing to decrease as better therapeutic measures are replacing it. Yet there is a claim made for the advantage of alcohol in old age.

"Bootleg" liquor is of three kinds, viz., (1) poisoned alcohol, commonly denatured alcohol which as sold legally is artificially and intentionally poisoned to render it unfit for use as a beverage; (2) raw alcohol—this contains many poisons chiefly aldehydes, which during aging of whiskey in the wood are oxidized to acids which combine with alcohol to form non-poisonous esters of pleasing taste and odor; (3) "cut" whiskey—aged and legal whiskey to which has been added denatured or raw alcohol, chiefly for the purpose of producing profits.

One of the outstanding conclusions is that stated by Emerson (page 428) that ". . . . health officers and health workers of all kinds are justified by the weight and implications of the recorded facts to use their powers of education to reduce to a minimum the use of beverage alcohol in their communities."

This text is a veritable mine of reliable information. There are still some disagreements and overlapping in the contributions of the different authors, but this is inevitable from the very nature of the case.

Since education is one of the essential factors in enabling the common people to reach intelligent and valid conclusions on the subject of alcohol, Dr. Emerson could confer a boon by having published a smaller, less technical report, arranged topically, which would be read and appreciated by a much larger circle than

will assimilate the present weighty edition.

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Legend of the Moat. (Play with Incidental Dances for Children.) Libretto by Mary E. Partridge and Buenta Carter. Music and Dances by Buenta Carter. (Clayton F. Summy Co., 1932) 35 pages. 75c.

Legend of the Moat is a story in three flights or scenes which might make use of children from all eight grades.

A "real Irish Grandmother" tells the story of two hunchbacks, one good, the other mischievous, to "the dear little girl." Because the one hunchback had always been so good and had also helped the fairies, they removed his hump and in turn added it to the mischievous one's hump.

The setting, which is any country scene without any houses but with the semblance of a hedge, does not change during the three scenes. Costuming does not prove a difficult problem since either modern clothes or an Irish peasant costume are used.

The music for the dances is lively and of a staccato nature which is so typical of Irish dancing. Naturally the music for the fairy dance suggests something very dainty and graceful.

This little Irish fancy is one which would appeal to most children and could be used by teachers who have not had much training in play production.

Louise McDonough
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Tap Dancing. Dexter Wright. (The Peters-Wright Studios, 1932) 52 pages. (Mimeographed) $1.50.

This book deals with the method of teaching tap dancing. The treatment of the subject is done so clearly, concisely, and uniquely that a person with little training would derive a great deal of benefit and help from the book. The explanations of time value of notes, as well as the mechanics of music, give the real relation of music to tap dancing, a point which is not always analyzed so clearly. A recommendation was suggested that the metronome be used also. The illustrations given in showing how the "shuffle" is to be executed are especially good. Mr. Wright has given most helpful suggestions throughout the book and has added much of interest in giving details of the origin of various steps, difference between tap and soft-shoe dancing, and there are good illustrations of the various kinds of tap shoes to be used.

Methods of Teaching Tap Dancing has a definite contribution and the book contains a wealth of valuable material including many routines.

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Education for Healthful Living in the Public Schools of Bellevue-Yorkville 1927-1931. Nina B. Lamkin (Bellevue-Yorkville Health Demonstration, 325 East 38th Street, New York, N. Y.) 55 pages. 50c.

This pamphlet describes an experiment in working out a practical program of health education designed to function as an all-day influence in the life of the school child and to assist the classroom teacher in interpreting such healthful living. The work was undertaken jointly by the Bellevue-Yorkville Demonstration, the Board of Education, and the Department of Health in thirteen schools located in the Demonstration area.

Miss Lamkin, who served as consultant, gives a clear picture of the physical conditions encountered in the schools and of the health program as it existed at the beginning of the experiment. She sets up four general objectives, describes in detail the working out of the program, and gives specific examples of health problems and how they were solved. A single sentence sums up an important phrase of health education in

our schools: "It would be useless to teach boys and girls the appreciation of classroom or personal cleanliness unless the school building itself was kept reasonably clean." Lighting, ventilation, sanitation, health inspection, nutrition (gaining and growing), and mental hygiene are some of the topics discussed.

The chapter on the newer methods for the Instruction of Supervisory and Classroom Teachers strongly indicates the need of preparation of the teacher of hygiene in changing from a subject-matter program to an activity program in healthful living. The Appendix contains samples of lesson plans that are excellent models for the classrooms.

Throughout the pamphlet emphasis has been given to the well-being of the individual child and planning for the child as a whole, rather than to the mechanics of the project. Statistics are used sparingly. Positive health is constantly stressed. Improved teacher-nurse cooperation played an important part in the results obtained.

Teachers in every type of school will gain new inspiration from reading of the results achieved under great difficulties. Would that every parent might also read this pamphlet. Perhaps then they would demand a school program that "will be a vital factor in promoting health and happiness in future schools, in homes, and communities—wherever children live."

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COACHING HIGH SCHOOL ATHLETICS. William G. Campbell; Ralph King Reed; and Howard Jones. (C. C. Crawford, University of Southern California, Los Angeles.) 207 pages. $2.00.

This book is probably the best source available to young coaches and directors of athletics for finding solutions to the problems they will meet in coaching and in the administration of the athletic program.

The authors in arranging the book devote a chapter to each problem. The problems and chapter headings are: The Place and Value of Athletics in Education; Coaching As a Profession; Arousing and Maintaining Interest in Athletics; How to Organize the Department; How to Develop Good Sportmanship; How to Develop Team Spirit; How to Lessen the Problem of Ineligibility; How to Gain Harmony and Cooperation Within the System; How to Give the School a Good Name in Athletics; How to Improve the Condition of Interscholastic Athletics; The General Technique of Teaching Games; and The Technique of Coaching Competitive Sports.

Each chapter contains several suggestions and solutions for the problem dealt with in that chapter. These are valuable as they are drawn from the actual experiences of successful coaches who have met these problems satisfactorily. Another feature of the book is that each chapter is followed by a list of true-false statements and a good bibliography. This book contains the most complete list of suggestions on these problems to be found in one volume and it is non-technical in nature and easy to read.

This book is a real contribution to the coaching profession as it is invaluable to coaches, prospective coaches, and those interested in the administration of athletics and physical education. The reviewer believes it should have a place in the library of institutions that train coaches as well as in the personal library of each coach.

CHAS. T. HUGHES
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THE PARENT AND THE HAPPY CHILD. Lorine Pruette. (Henry Holt & Co., 1932), 290 pages. $2.00.

Dr. Pruette is an interesting speaker. Her book on *The Parent and the Happy Child* displays the same colorful and realistic approach to her subject. She

deals with the psychology of family life and the psychology of child development, adding a useful section on ways for a parent to measure his or her own performance on a check list.

Dr. Pruette is particularly successful in describing the emotional, instinctive reactions of adults to family life and in indicating the way in which the adult's attitudes must necessarily affect the child's world. In the chapter on "The Married Partner" she describes concretely and interestingly the process of re-education of a trait of one adult by another.

For the details of age changes during the years of childhood a reader can go to other authors. Dr. Pruette succeeds in giving a good general picture of a child's growth and development especially from the point of view of the molding of his emotions.

In the parental inventory given in Part III there might be certain additions or changes as for instance in number 71:

"71. Do I seek to learn all I can about each child's mental ability, special abilities, etc. (or do I assume that *my* children must inevitably be superior)?"

Very likely many parents have a disconcerting conviction that their children are inevitably *inferior* to other people's children. And in item 93:

"93. If my child fails, at school, at work, in social life, will I react to this as a personal shame and turn my feeling of outrage upon the child or will I encourage him to try again, letting him know that his family still has confidence in him?"

The statement of a parent's attitude might be improved here by leaving out "still" and saying instead, "letting him know that his family has confidence in him."

The reading list for parents which is given in Part III seems to the reviewer to include material too difficult except for unusually intelligent, trained adults. A study course could be constructed made up of material which gives more explanation and interpretation of the fundamental facts of parent and child psychology.

The selection of the picture for the dust cover is somewhat unfortunate in that the little girl who was photographed seemed at the moment not to be "happy" but highly (though pleasurably) excited. One would guess that she had just been vigorously stimulated by an adult. It would have been better to use a picture which showed a child absorbed in his own satisfying activities.

Dr. Pruette is, throughout, simple and clear and she is always sound. Her book will be found readable and valuable both for teachers and for parents.

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